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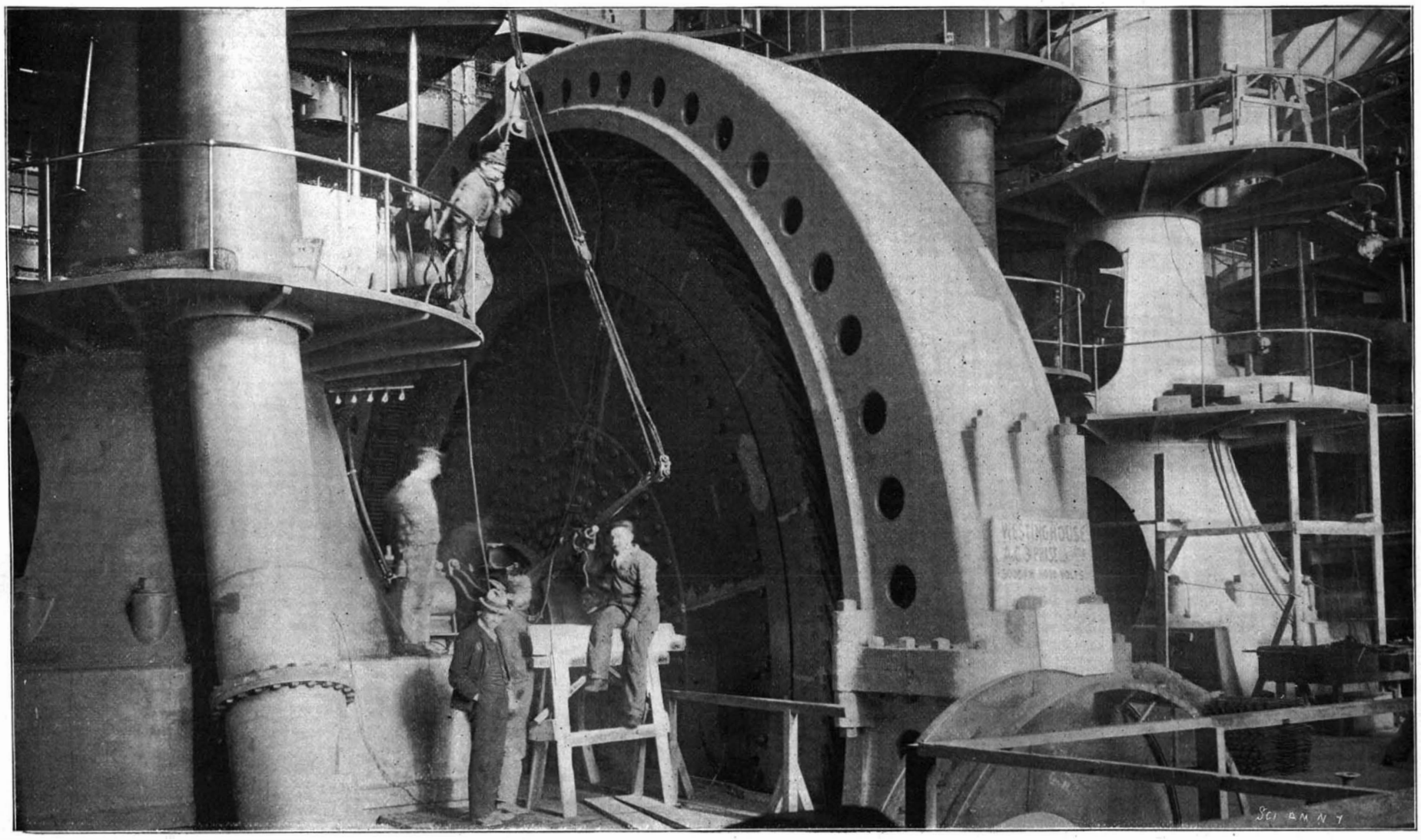
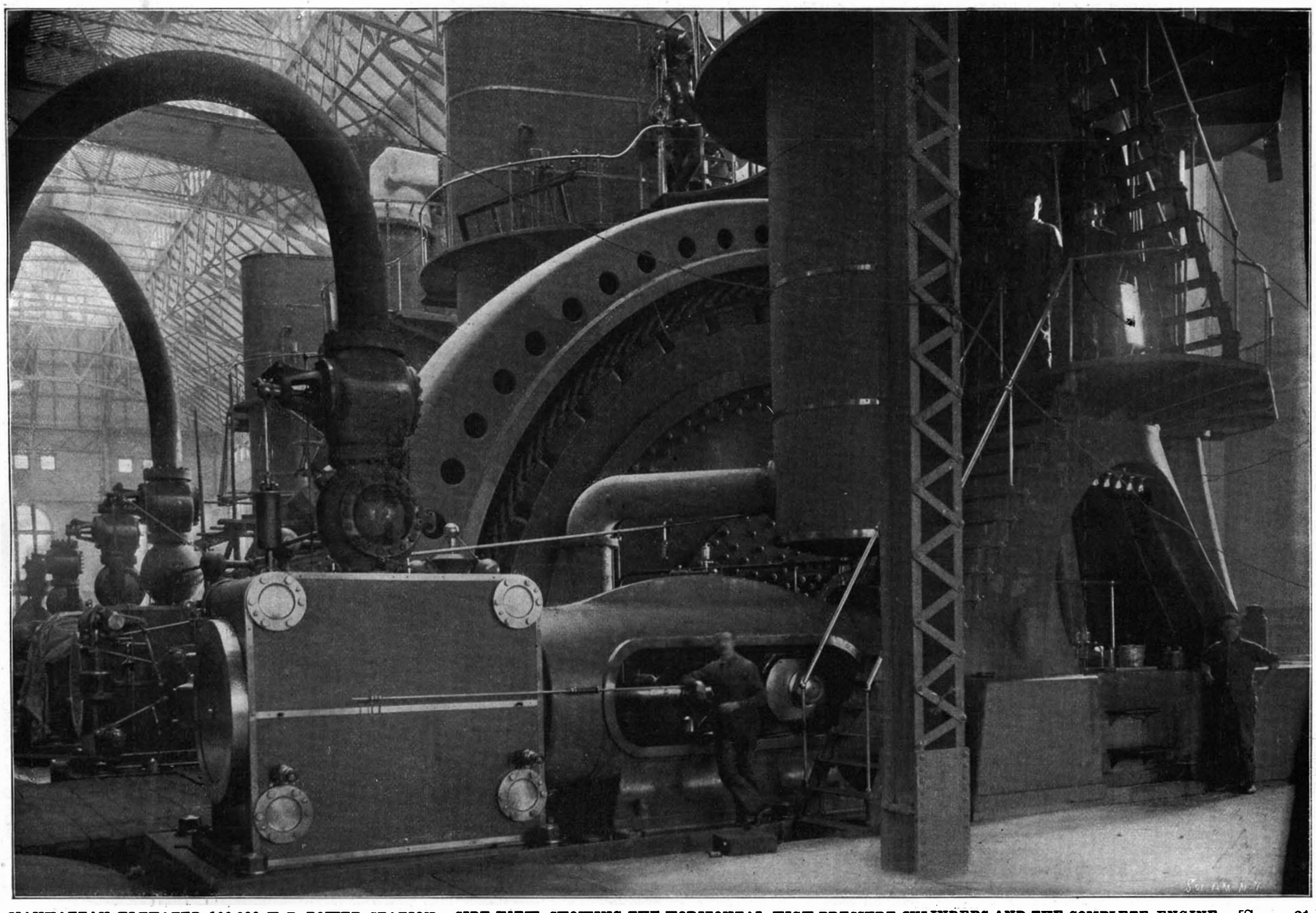
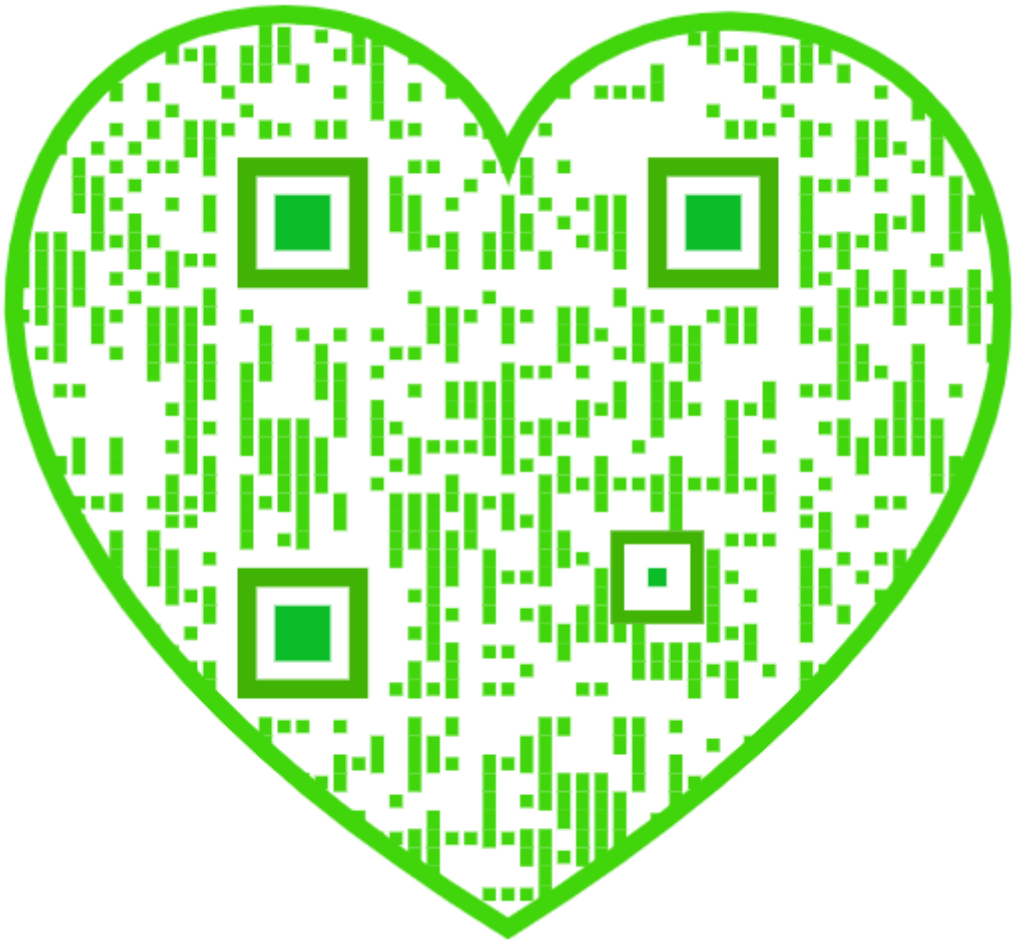


Front View of One of the 12,500 Horse Power Engines, Showing the 42-Foot Alternator.



MANHATTAN ELEVATED 100,000 H. P. POWER STATION.—SIDE VIEW, SHOWING THE HORIZONTAL HIGH-PRESSURE CYLINDERS AND THE COMPLETE ENGINE.—[See p. 21.]



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NEW YORK, SATURDAY, JANUARY 11, 1902.

The Editor is always glad to receive for examination illustrated articles on subjects of timely interest. If the photographs are *sharp*, the articles *short*, and the facts *authentic*, the contributions will receive special attention. Accepted articles will be paid for at regular space rates.

THE ALCOHOL MOTOR AND ITS POSSIBILITIES.

France imports all her petroleum. She also produces more alcohol than her citizens can use. Undoubtedly this state of affairs led patriotic French engineers to begin a series of experiments some two years ago for the praiseworthy purpose of using alcohol as a motive agent instead of foreign petroleum, and of filling the pockets of the impoverished peasant.

These experiments bore little fruit, largely because nothing was known of the behavior of alcohol when used in a motor. Two years ago in the Paris-Chantilly contest only one alcohol carriage succeeded in finishing. Perhaps the bad weather then prevailing had much to do with the failure of the other alcohol-driven vehicles. Nevertheless, the performance of the one successful carriage was so discouraging and the consumption of alcohol so inordinate that it was feared gasoline would never be supplanted. With the Paris-Rouen test the prospects brightened somewhat. Finally the Paris-Roubaix contest won for the alcohol motor a certain prestige which it will probably continue to hold.

Encouraged by these results and prompted by the desire to furnish chauffeurs with much-needed information on the efficiency of alcohol as a motive agent, the French Minister of Agriculture recently instituted a series of tests, the tabulated results of which will be found elsewhere in this issue. For the first time engineers are now supplied with accurate data which give them what they never had before—a trustworthy means of comparing alcohol with petroleum and other motive agents. For this reason alone the Minister of Agriculture's researches should receive their full meed of praise.

Compared with the gasoline motors, it cannot be denied that the alcohol engine seems at first distinctly inferior. When the price of alcohol and the greater consumption of fuel are considered, an automobilist is inclined to cling to his gasoline motor. Moreover, the *alcool denaturé* has a calculated thermic value of only 5,297 calories per kilogramme; while the calorific value of gasoline in 11,400. In order, therefore, to cheapen the alcohol and to increase its thermic value, rectified benzine is used as an enriching agent. Exactly what the proportions of the mixture of alcohol and benzine should be was no very easy matter to determine. It has now been definitely ascertained that a 50 per cent mixture (called "electrine"), the heat value of which is 7,479 calories per kilogramme, is most serviceable. In the tests referred to the effective utilization of the alcohol was divided by the product of the amount of alcohol consumed per horse power, and multiplied by the percentage of carbonizing liquids contained in the mixture. Consequently, the more alcohol and the less carbonizing liquid a motor consumed, the higher would it stand in the final lists. Many tests have shown that the consumption of 50 per cent carbureted alcohol is about equal to that of gasoline for the same power, despite the pronounced difference between the theoretical calorific values of the two.

A critical examination of the tables which we publish on another page will show that in consumption the alcohol motor is more economical for higher than for smaller powers. To be sure, economy increases with the power in all motors. Nevertheless, it is certainly remarkable that a 14 horse power Gobron-Brillié two-cylinder motor, mounted on a 1,224-kilogramme carriage, should consume only 125.07 cubic centimeters of 50 per cent alcohol per ton-kilometer; while a voiturette weighing 490 kilogrammes and driven by a single-cylinder 6 horse power motor should consume, under the same conditions, 155.4 cubic centimeters per ton-kilometer. Perhaps the most satisfactory figures are those tabulated for cars of 650 to 1,000 kilos and over. In this class the efficiencies seem to have been exceptionally high. In compiling the tables effective normal operation, regularity and smoothness of running under variable loads, trustworthiness of ignition, ease of starting, general excellence of construction and simplicity were all considered. For that reason motors which, from the tables, would seem to have consumed a very small amount of alcohol, are nevertheless rated very low; the road tests evidently revealed some defect.

The relative high efficiency of alcohol is attributed to the expansion of the water-vapor contained or produced in the alcohol at the moment of explosion. The expansion imparts elasticity to the motive agent and reduces the shock of the explosion. In order to utilize this excellent property still further, a German manufacturer recommends a mixture containing 20 per cent water, and claims that by its use he has reduced the consumption to 0.375 kilogrammes per horse power hour. In France still better results have been obtained. There the consumption has even been cut down to 0.272 kilogrammes per horse power hour.

As a result of the tests instituted by the Minister of Agriculture inventors will probably seek to improve the alcohol motor. For improvement there is certainly much room. The longer expansion of carbureted alcohol will require a motor longer in stroke and heavier than the gasoline engine. But for automobile use motors cannot be much increased either in volume or in weight. To devise a motor which will permit the most efficient utilization of alcohol without inordinately increasing the weight will be a rather nice problem to solve.

LARGE STATIONARY AND MARINE ENGINE UNITS.

On another page will be found a description of the powerful stationary engines for driving the alternators of the new Manhattan Elevated power house. These engines are the most powerful of their type extant, and greatly exceed the units built for the power house of the Metropolitan Street Railway Company, each of which has a rated horse power of 4,500 and a maximum of 6,000 horse power. The engines of the latter plant are of the vertical, cross-compound type, with cylinders 46 and 86 inches diameter by 60 inches stroke. There are eleven units, and the maximum horse power of the station is therefore 66,000. In the new Kingsbridge station of the Third Avenue Railway Company the engines will have a maximum rated horse power of 6,250, and as there will be sixteen of these the total horse power of the station will be 100,000. The Metropolitan and Kingsbridge engines are practically alike in type, although the former were built by the Allis-Chalmers Company and the latter by the Westinghouse Machine Company.

The magnificent engines of the Manhattan station at 74th Street are of a new type. Each unit is made up of two compound condensing engines, one at each end of a 34-inch shaft, at the center of which is carried a huge 42-foot alternator, of which the 32-foot revolving field weighs 185 tons, the whole alternator weighing 445½ tons. The engine consists of two high-pressure cylinders of 44 inches diameter and two 88-inch low-pressure cylinders, the common stroke being 60 inches. With 150 pounds' boiler pressure and a speed of 75 revolutions per minute the engine will develop a maximum indicated horse power of 12,500.

These figures afford an interesting comparison with the largest marine engines extant, which are installed on the Hamburg-American steamer "Deutschland." Here the total horse power of 37,500 is developed by twin engines, 18,750 horse power being developed on each shaft. Each engine is therefore 50 per cent more powerful than the engines of the Manhattan plant. There are six cylinders working on four cranks, the two high-pressure cylinders being arranged in tandem above the two low-pressure cylinders. Steam at 225 pounds pressure is led from the boilers to two 36⅝-inch cylinders, from which it passes to a 73⅝-inch first intermediate, then to a 104-inch second intermediate, and finally to two 108-inch low-pressure cylinders. Forced, hot draft is used at the furnaces, and the consumption of coal for all engines is 1.45 pounds per horse power per hour, or excluding the auxiliaries 1.3 pounds. It should be added that the stroke is 72 inches, and the speed of revolution at 37,500 horse power about 80 per minute.

It will be noticed that there is a wide difference between the marine and stationary engine practice as exemplified in these, the two largest units ever built for their respective classes of work. The marine engine is characterized by high steam pressure, high piston speed, multiple expansion and great compactness, while the stationary engine uses what would be called in these days a low steam pressure, while the piston speed is relatively low, and multiple expansion is only carried to the point of compounding instead of the point of quadruple expansion as in the marine engine. Each type is well fitted for its particular duty, and the difference in practice is explained by the conditions imposed. In the case of the marine engine, space is limited, and it is therefore necessary to get the largest rate of horse power per unit of weight of engine. On the other hand, in the case of the stationary engine there are no strict limitations of space imposed. Economy of weight is not a prime consideration, and hence, compared with the engines of the "Deutschland," it will be found that the Manhattan units are much more liberal in apportionment of weights, and that in valves, condensers and other details there is an apparent clinging to old practice which would be conservatism in marine work, but is not so under the conditions which govern the operation of large stationary power plants. The marine engine is run at high pressure for five or six days consecutively, and is then turned over to a repair gang who have four or five days of uninterrupted work in which to give the engine a thorough overhaul ready for her next five days of running. No such thing is possible at a stationary plant, which must be run steadily day and night under variations of load such as never occur in marine practice.

AUTOMATIC CLOSING OF WATERTIGHT BULKHEADS

Although theoretically there is a large degree of safety secured by the complete subdivision of the interior of modern steamships by means of watertight bulkheads, the too frequent failure of this system to keep vessels afloat after collision would seem to suggest that the advantages are more theoretical than real. As a matter of fact, it will be found on investigation that where a well-divided ship has foundered the fault has been not in the system of subdivision so much as in the many perforations of the watertight bulkhead by doorways and passageways below the water-line. Although such openings are supposed to be guarded by watertight doors, it is evident that the value of the subdivision is finally and absolutely dependent upon the efficient oversight of these doors and the care that is taken to close them in the event of collision. Many naval architects have endeavored to overcome the difficulty by absolutely prohibiting the construction of watertight doors below the water-line; but this arrangement involves great inconvenience, especially in passenger ships, as all communication from compartment to compartment necessitates climbing to the upper deck and descending into the desired section of the ship. The compromise which seems best to meet all the conditions is that which permits of a certain number of watertight doors below the water-line, and the installation of a system by which they can all be automatically and simultaneously closed from a central station in case of collision. One of the most successful systems of this kind is that which has been installed on the "Kronprinz Wilhelm," which is known as the Dörr hydraulic watertight system. The central station is located on the bridge, and in the event of collision the officer first moves over a lever, which sets an electric bell ringing for twenty seconds at every bulkhead door. At the end of that period the lever releases the throttle wheel for starting the hydraulic closing cylinders, on turning which the doors are released and closed. When the door reaches the bottom of its seating it closes an electric circuit, and a corresponding glow-lamp in a plan of the bulkheads in the pilot-house is illuminated. The system appears to be thoroughly satisfactory, and is being applied to every vessel in the company's fleet.

THE FIRST IRON VESSEL IN GREAT BRITAIN.

BY ANSLEY IRVINE.

It is interesting to note that it was as early as the year 1809 that Robert Dickenson, the eminent inventor, first suggested to the Admiralty a scheme by which the old wooden ships of the Royal Navy were to be gradually replaced by vessels built of iron, and thus make the English fleet incomparably stronger than any combination that could be brought together by foreign nations.

The proposed innovation was promised due consideration, and, in 1830, twenty-one years afterward, the conclusion arrived at by the Admiralty was that iron vessels would be practically useless in the line of action and totally unmanageable in a storm! Absurd as the assertion now appears, it was, nevertheless, ardently supported by Dr. Lardner, a scientific authority, who said the idea was perfectly chimerical and that there was about as much chance of an iron boat reaching New York as there was of its voyage to the moon.

A fierce storm of invective and derision was waged against all who had the temerity to hold an opinion contrary to that of the Admiralty and its "scientific" supporters. But Thomas Wilson, a young Scotch boatbuilder, ignored the bigoted opposition, and, in 1816, commenced to build a boat of iron at Fasken, Scotland. She was named the "Vulcan." Her dimensions were 60 feet in length, 12 feet in breadth, and 5 feet in depth. All the plates, rivets, and angle-irons were made over the anvil by Wilson and his blacksmith. The plates were fixed perpendicularly or boiler-fashion, not horizontally as in modern iron ships. The boat was specially constructed for the passenger service on the Monkland Canal, and plied between Port Dundas and Loch No. 16.

When the "Vulcan" was being built, Wilson was severely ridiculed by the craftsmen on the canal—which ran close to his yard—who, when passing, would drop small pieces of iron into the water and sarcastically inquire if he expected his boat to "soum." And as soon as it became known in the neighborhood that an iron boat was being built, the villagers came down to the yard and gazed open-mouthed at the phenomenon. In a short time deputations of the skeptically inclined began to intercept the builder on his way home and endeavor to point out the foolishness of the undertaking. When the "Vulcan" was nearing completion, Wilson was one morning surprised to find them coming down to the water's edge with pots and pans to try their buoyancy and once and for all convince themselves that iron would float.

After the boat was launched she proved so great a success that the representatives of the Forth and Clyde Company commissioned Wilson to build several other similar barges for their cargo and passenger traffic.

The "Vulcan," passing ultimately into other owners' hands, was broken up after being in use over sixty years. It is said she could have continued to do good service for many more years, so remarkably sound had she been built, but she was considered obsolete for trading purposes, having been superseded by more modern boats. Shortly after the "Vulcan" was launched Wilson accepted a post in the Forth and Clyde Canal Company, and for fifty years served them in the capacity of chief engineer, retiring on a handsome pension, which he lived to enjoy for many years. He died at his residence, Zetland Place, Grangemouth, on November 1, 1873, at the advanced age of 92.

CLARENCE KING.

BY MARCUS BENJAMIN, PH.D.

Clarence King was born in Newport, R. I., January 6, 1842. His boyhood was passed in Newport, and as he grew older the long summer vacations were spent in camping out with youthful associates among the Green Mountains, where he led an open-air life of hunting and fishing, and at the same time absorbed a knowledge of natural history and botany.

His early fondness for natural history seems to have marked a decided predilection for scientific studies, and accordingly he entered the Sheffield Scientific School of Yale University, where he was graduated in 1862.

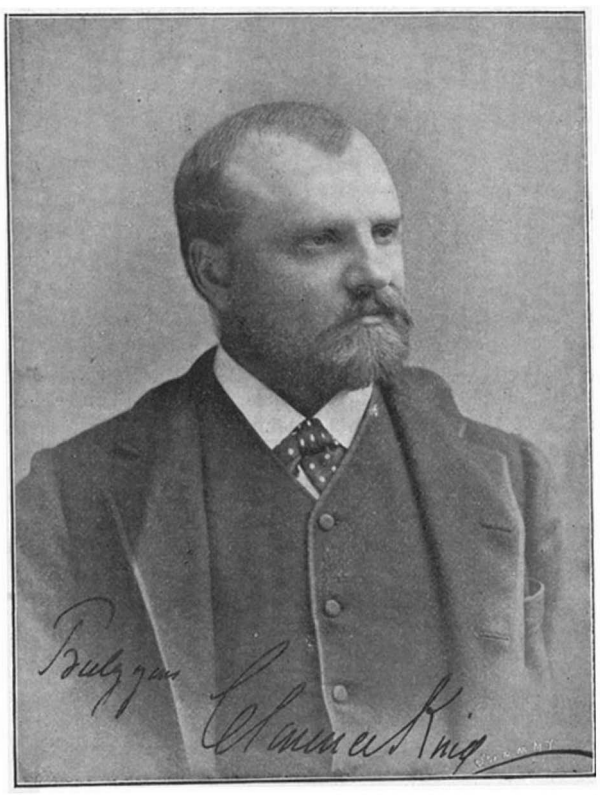
A year later, with James T. Gardiner, a college associate, he crossed the continent, traveling on horseback from the Missouri River to California, making careful geological observations during the journey. On reaching the Pacific slope he met Josiah D. Whitney, the eminent geologist, who was then conducting a survey of California; and accepting an appointment with that work, he continued with the survey until 1866. Of special interest were his paleontological studies, which furnished evidences on which rest the determination of the age of the gold-bearing rocks. It was at this time that he discovered and named Mount Whitney and Mount Tyndall, and on climbing these peaks found them to be the highest group discovered in California.

He returned to the East in the autumn of 1866, and then originated an elaborate plan for the complete geological section of the western Cordillera system at its widest expansion of the fortieth parallel. The Chief of Engineers and Secretary of War sanctioned the plan, and the necessary legislation in Congress was secured by the personal labors of Mr. King, who, early in 1867, was appointed to the charge of the survey.

Accompanied by a large and able staff of his own selection, and wholly civilian, he took the field in 1867, and for five years prosecuted the work in accordance with the original plans and instructions. It is impossible to describe the work which he did in any detail, but it has been admirably summarized as "a signal contribution to the material of science, establishing standards and methods of the highest order for the Geological Survey of the United States which followed in natural sequence."

Meanwhile an occurrence of unusual interest happened in which, fortunately, he took part. Early in 1872 much attention was called in this country and in Europe to the alleged discovery, somewhere in the far West, of new diamond fields of unparalleled richness. Large quantities of precious stones had been brought thence and judged by experts to have great value. Reports which received the confidence of capitalists were made in New York and San Francisco, setting forth the great importance of the new find, and resulted in the formation of several companies to exploit the field. As it afterward appeared, many thousands of dollars' worth of rough diamonds, rubies, emeralds, and other gems had been purchased in London, brought to the chosen locality and sown with a free hand on the ground or carefully stuck into anthills. Much excitement prevailed, and there can be but little doubt that, if the swindle had remained unexposed for a short while longer, there would have been a rush to the supposed sources of wealth like that which followed the discovery of gold in California. The precise locality was kept secret for some months, and the impression prevailed that the diamond fields were in Arizona. The discovery that they were within the official limits of the Fortieth Parallel Survey was fortunately made by one of Mr. King's staff, and he immediately set out for the designated locality. The swindle had been skillfully prepared, even to the choice of a locality geologically favorable, and the "salting" had been so cunningly and artfully done that it had already deceived honest experts of much experience; but on the second day after his arrival Mr. King's suspicions were aroused, and he at once began a series of careful observations from which it clearly appeared that the gems were found in positions where nature alone could never have placed them, and were not to be found in places where, had the occurrence been genuine, the inevitable laws of nature must have carried them; that near every anthill found to contain gems might still be seen the storm-worn footprints of mankind, while anthills free from human tracks were also void of precious stones; and, finally and unquestionably, that some designing hand had "salted" the fields with deliberate and fraudulent intent. The public announcement of this result was followed by the immediate bursting of the bubble; but had this been delayed only a little while, it is certain that great disappointment, distress, and loss of money would have been suffered by many victims of the fraud.

In 1878 the various known surveys then in the field,



THE LATE CLARENCE KING.

organized under different departments of the government, were consolidated into the United States Geological Survey under the direction of the Secretary of the Interior, and the Directorship was offered to Mr. King by President Hayes. He accepted the office with the distinct understanding that he should remain only long enough to appoint its staff, organize its work, and guide its force into full activity, and, accordingly, in 1881, he withdrew from active work in order to devote himself to special geological investigations.

During the course of his labors on the geology of the western part of the United States, conclusions that the problem of the action of the forces that built the mountains of the continents had not been studied with sufficient closeness forced themselves upon him. He therefore undertook a series of laboratory experiments to determine the action of the primal constituents of the early globe under conditions of heat and pressure assumed to exist when the material of the earth was separated from the sun. The chemical and physical work required by these experiments was very expensive, and had not been completed at the time of Mr. King's death.

Mr. King was a member of many scientific societies both in this country and abroad, and in 1876 was chosen a member of the National Academy of Sciences. He was a contributor to magazines and reviews and was the author of "Mountaineering in the Sierra Nevada" (Boston, 1871), an admirable book of travel which describes his life as an explorer in the unknown heights of the greatest of our American ranges.

In recent years his health steadily failed, especially since the early winter of 1893, when he was for a time a sufferer from a mental difficulty, and during the cold months of the present winter he sought relief for pulmonary troubles in the dry climate of Arizona. He was in Phœnix when the end came, and died there on December 24.

SCIENCE NOTES.

Mr. F. Bowden, president of the Cycle and Motor Trades Association, England, states that the cycle trade gives employment to over 100,000 people in that country, and is the means of distributing an enormous sum per week in wages. The average profit per bicycle made by the manufacturing companies during 1900 amounted to only $2.16.

Acetylene gas lamps are being introduced into the omnibuses of London, in place of the disagreeable oil lamps which have hitherto been used. By this means the interior of the vehicle will be illumined by a bright white light. Contracts for 2,000 acetylene gas lamps for this purpose have been placed with the Phôs Company by the various omnibus companies, and the work of installing them upon the vehicles is proceeding rapidly.

The most ambitious attempt to navigate the air ever made, in the matter of expense certainly, is that of Count Zeppelin's dirigible balloon, familiar to our readers by illustrated articles. It is asserted in foreign exchanges that the shed at Lake Constance which contained it has been demolished and all employés dismissed; no more money being forthcoming to prosecute experiments, the air vessel itself will probably be broken up.

Statistics carefully compiled show that 9,000 persons went to Nome this season, and that 10,200 have returned or are returning, leaving about 4,000 in the district for the winter. There were 80 vessels, steam and sail, engaged in the Nome traffic, carrying from Seattle 55,000 tons of general freight. The estimated receipts for the transportation of freight and passengers are $1,874,000, and the value of the freight shipped from Seattle $5,500,000. About $4,500,000 gold has been shipped from Nome this season.

The French Minister of Public Works has issued a decree prohibiting the railroad systems of France from working their men more than twelve hours out of twenty-four. Signalmen, switch tenders, trackmen and watchmen at duty on grade crossings must have an uninterrupted break for at least eight or nine hours. One hour is to be allowed in the middle of the day for meals, and each is to have one day or two half-days a month free, and employés are forbidden to work more than two months consecutively without taking at least one day's vacation. The railroad companies have ninety days in which to arrange for the practical working of the new decree.

In striking contrast with the financial failure of the recent Buffalo Exhibition, is the unqualified success that has attended the International Exhibition at Glasgow, Scotland. During the seven months it was open 11,496,220 people passed through the gates—double the number that attended the exhibition of 1888. The last day was the most successful, the attendance numbering 173,266. The total receipts of the former exhibition were $566,330, and a surplus of some $200,000 resulted. The total receipts from the recent exhibition amount to approximately $850,000, and it is anticipated that the profits will amount to $400,000. Over 100,000 season tickets alone were disposed of. The only expressed dissatisfaction of a serious character was the absence of side shows—entertainments of the lighter character. As a digest of the industrial world, and particularly of Scotland, the exhibition has been generally regarded, if not the largest, as the most varied and representative exposition of the kind ever held.

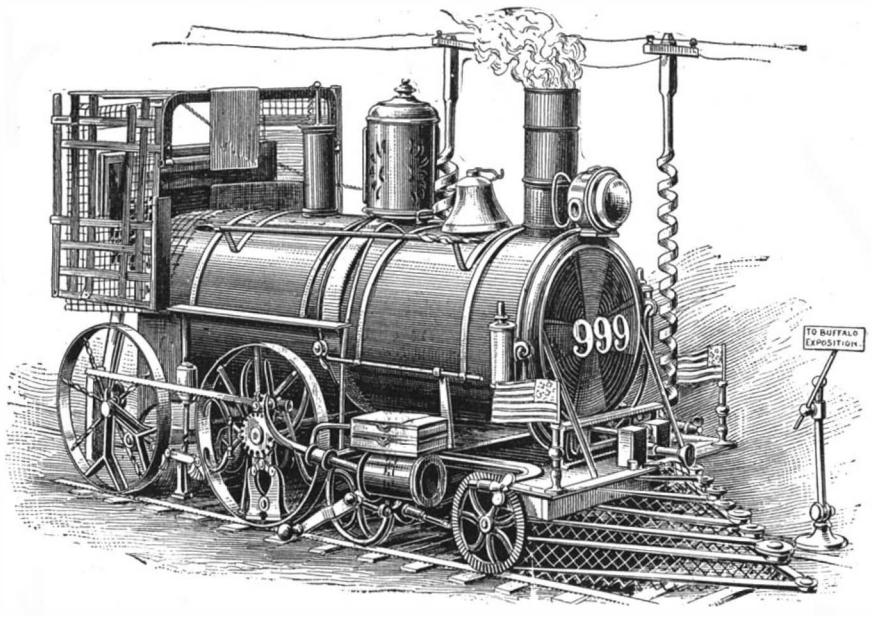
Although Würtemburg is only a small state of little more than 2,000,000 inhabitants, and a revenue of less than $20,000,000, it possesses one of the best controlled and thoroughly efficient systems of scientific education in the world. At Tübingen there is a State University, which has long been formed. Not only does it give the highest education, but does so cheaply. Below the university are a technical high school and a Royal building trades school, both at Stuttgart. At Rentlingen is a textile technical school; at Schwenningen a school of mechanical industries. In other centers are three weaving schools, two weaving workshops, and a knitting school. In addition to these provisions there are 231 towns and villages provided with industrial improvement schools, the subjects being adapted to local exigencies. To spread the influence of this teaching, industrial courses of lectures and demonstrations are given wherever required in such subjects as bootmaking, metal-making, joinery, painting, braziers' work, etc. Women are not neglected. Eighteen improvement schools are provided, as well as a commercial college at Stuttgart, and two commercial improvement schools. All these institutions are replete with the most modern apparatus, etc., to insure sound teaching. The system is so excellent that foreign students are seeking to avail themselves of its advantages to such a considerable extent, that the authorities have had to impose special heavier conditions for foreigners.

A HARDWARE LOCOMOTIVE.

A locomotive 42 inches long and 20 inches high stands in the show window of A. W. Gerstner, 632 to 634 Eighth Avenue, New York, says The Iron Age, to whom we are indebted for our engraving. It is constructed entirely out of articles taken from their stock by Sidney Stansbury, one of the clerks, who claims it contains some radical improvements over the famous Empire State engine, No. 999, after which it was modeled.

The several parts of the locomotive were made up as described below: Boiler, two plumbers' furnaces; head of boiler, one ventilator; front truck, four hand drills; platform for truck, two squares and six scale rules; cylinders, two piano makers' glue pots; steam chest, four pocket levels, four scrapers; steam pipe, two blowpipes; cow catcher, six calipers; draw head, dowel pointer and wire cutter; front rod to boiler, two legs of Starrett's dividers; piston rod, two legs of Starrett's dividers; frames and guides for piston rod, two hack-saw frames; Westinghouse air brakes, two chucks; shoe for same, two thread gages; connecting rod for driving wheels, two saw blades; cab, hack-saw frames and blades; smoke stack, one plumbers' grease cup; head light, one pocket lantern; bell, one hand bell; sand box, one brazing lamp; sand box tube, two blowpipes; whistle, one brazing lamp; hand rails on boiler, two bell hangers' bits; walk along boiler, two steel rules and two brass rules; smoke, Russia hemp rope; telegraph poles, three shin augers; railroad sign, one surface gage; side lights, two alcohol torches; eccentric rods, two blowpipes; firebox, two combination squares with center heads.

The four driving wheels are 8 inches in diameter, each being brass bound. The hubs of each are made of wire gages. The spokes of the first are composed of a pair of Starrett's cutting nippers, two thread calipers and center punch; the second of two center heads, two scale rules, four twist drills and two flat metal drills; the third of four pin vises and four screwdriver bits, and the fourth of one pair of Hall's cutting nippers, one pair end cutting nippers and five taps. Electric wire couplings were used for the driving rod pins. The track is made of saw webs and the ties of two-foot rules.



A HARDWARE LOCOMOTIVE.

THE LAUNCH OF THE BATTLESHIP "MISSOURI."

The battleship "Missouri," which was launched at the Newport News Shipbuilding and Dry Dock Company's yards on December 28, 1901, is the last of the three fine battleships of the "Maine" class to take the water. The "Maine" was launched at the Cramps shipbuilding yards, Philadelphia, Pa., May 30 of last year, and the "Ohio" was launched on May 22 at the yards of the Union Iron Works, San Francisco, Cal.

The "Missouri" is an enlarged "Alabama," with all the excellent characteristics of that ship and the added advantages of higher speed, larger coal capacity and a more powerful battery. The dimensions of the "Alabama" are: Length, 360 feet; beam, 72 feet 2½ inches; mean draft, 23 feet 6 inches; displacement, 11,656 tons; speed, 16 knots; and maximum coal supply, 1,355 tons. As at first designed, the "Missouri" and sister ships were to have been similar in size and speed to the "Alabama" class; but ultimately it was decided that, in view of the high speed being given to foreign battleships that were building when the "Missouri" contract was about to be let, the contractors should be asked to draw up designs of their own for vessels of 18 instead of 16 knots speed. To provide for the increased motive power necessary, and to secure the finer lines to suit the higher speed, the vessels were made 20 feet longer, the breadth and draft remaining the same, while the displacement was increased from 11,565 tons, as in the "Alabama," to 12,230 tons in the "Missouri." To secure the necessary 16,000 horse power for 18 knots speed, the "Missouri" is equipped with water-tube boilers and twin-screw vertical, triple-expansion engines. The displacement given, 12,230 tons, is that of the vessel when she is fully equipped, ready for sea, with all stores on board and a normal coal supply of 1,000 tons. When loaded to her fullest capacity she will displace 13,500 tons.

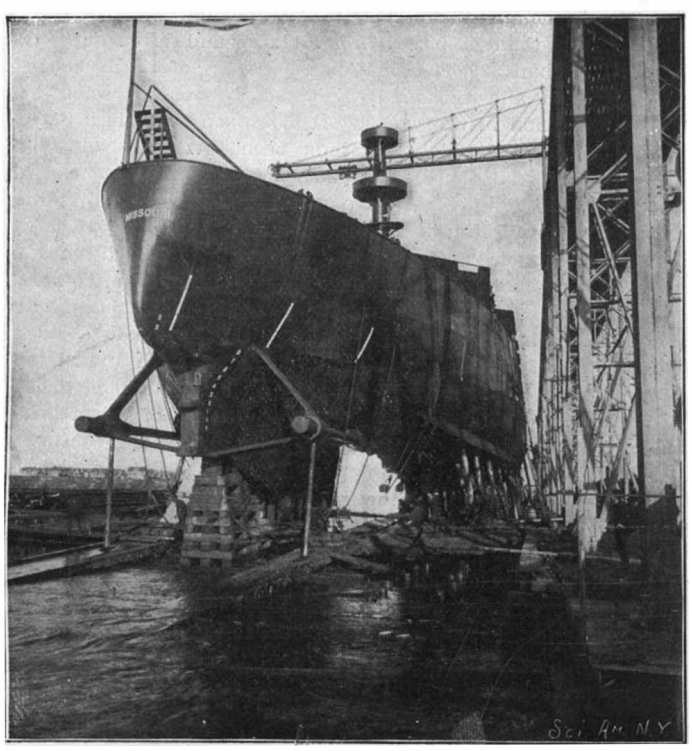
Both for offense and defense these ships are among the most powerful in the world. In the first place, they have an armor belt extending from the stem more than two-thirds of the way aft, which has a maximum thickness of 11 inches at the top and 7½ inches at the bottom, this thickness being maintained in the wake of the engines and boiler room. From the forward barbette the belt tapers to a thickness of 4 inches at the stem. Above the main belt there is a complete wall of 6-inch armor which covers the sides of the vessel between the main barbettes and extends to the level of the spar deck. Diagonal bulkheads of heavy armor extend from the main belt to a junction with the barbettes, while above the main bulkheads are bulkheads of 6-inch armor reaching from the 6-inch side armor to the main barbettes. The protection thus afforded against an enemy's projectiles is supplemented by the coal bunkers, which extend in the wake of the 11-inch and 6-inch side armor, and present a thickness of from 6 to 10 feet of coal against penetration by projectiles which might effect an entrance through the Krupp armor. Further protection against the entrance of water is afforded by a belt of cellulose, 3 feet in width, which is worked in at the back of the 6-inch armor at the point of its junction with the main 11-inch belt. The main barbettes for the 12-inch guns are protected with 12 inches of Krupp armor, while the turrets are 11 inches in thickness, except on the port plates, where the armor is increased to 12 inches.

The main battery of four 12-inch guns is carried in the two main turrets forward and aft. The secondary battery consists of sixteen 6-inch rapid-fire guns. Of these, ten are mounted on the main deck behind the 6-inch armor, each gun position being separated from the next by a screen of 2-inch armor. Forward, toward the bow on the same deck, are two separate gun positions, protected by 6 inches of Krupp armor, in which are mounted two more of the 6-inch battery, while the other four 6-inch guns are carried two on each side of the vessel upon the spar deck, the protection consisting of 6 inches of steel. The rest of the rapid-fire battery consists of six 3-inch guns, four of them mounted on the gun deck aft and two of them on the main deck forward; eight 6-pounders and two 1-pounders mounted on the bridges and fighting tops, besides two Colts and two 3-inch field guns.

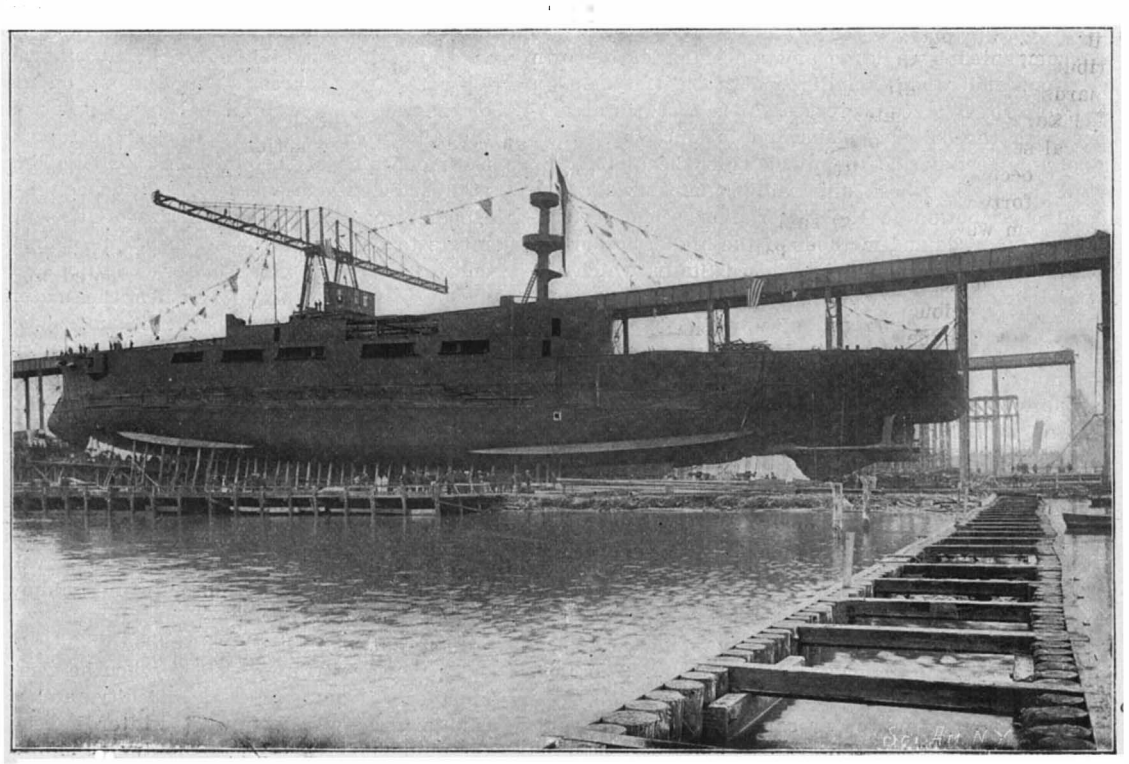
A new feature which has not before been adopted in the United States navy is the submerged torpedo tube, of which the "Missouri" will carry two. The dangers of above-water torpedo tubes were well exemplified in the Spanish war and in the battle of the Yalu between China and Japan. In both wars a vessel which carried above-water tubes was completely wrecked by the detonation of its own torpedoes—the result of their being hit by the enemy's shell fire. The torpedo tubes on the "Missouri" are located well below the water-line at about the depth at which the torpedo is desired to travel, and the firing stations for these tubes, which are above the water-line, are well protected by armor.

Although the "Missouri" has substituted the lighter 12-inch gun in her main battery in place of the 12-inch gun carried by the "Alabama," she will be able to deliver a much more powerful fire from these guns alone. Moreover, she carries two more guns of 6-inch caliber, and several of the very effective 3-inch pieces. All of these weapons are of the new long-caliber, smokeless-powder type, the 12-inch guns being 40 calibers in length and the 6-inch and 3-inch 50 calibers in length. The 12-inch gun has a muzzle velocity of 2,800 foot-seconds, and a muzzle energy of 46,246 foot-tons; the 6-inch piece has a muzzle velocity of 29,000 feet per second and a muzzle energy of 5,838 foot-tons; while the 3-inch gun has a muzzle velocity of 2,800 feet per second and a muzzle energy of 709 foot-tons. At 3,000 yards the 12-inch projectile, if provided with a soft cap, can penetrate 19.5 inches of Krupp steel, while the 6-inch projectile, if capped, can penetrate 5.9 inches of steel. The high velocity and consequent flat trajectory of the new guns increase greatly the danger zone, that is to say, errors of sighting are greatly reduced and the point-blank range is increased. Hence the number of hits that are liable to be scored by a gun crew will be much larger with the new guns than with the older weapons which they have supplanted. The "Missouri" will have a complement of 551 officers and men.

A new bath for the easy development of a quantity of negatives simultaneously has been devised by Herr Simonis. The dish is made of glass or glazed earthenware. It has a raised ridge running along the bottom of deeply corrugated sides. The photographic plates fit in the corrugations and rest on the bottom ridge so that the solution circulates between the plates over the films.



STERN VIEW OF THE BATTLESHIP "MISSOURI."

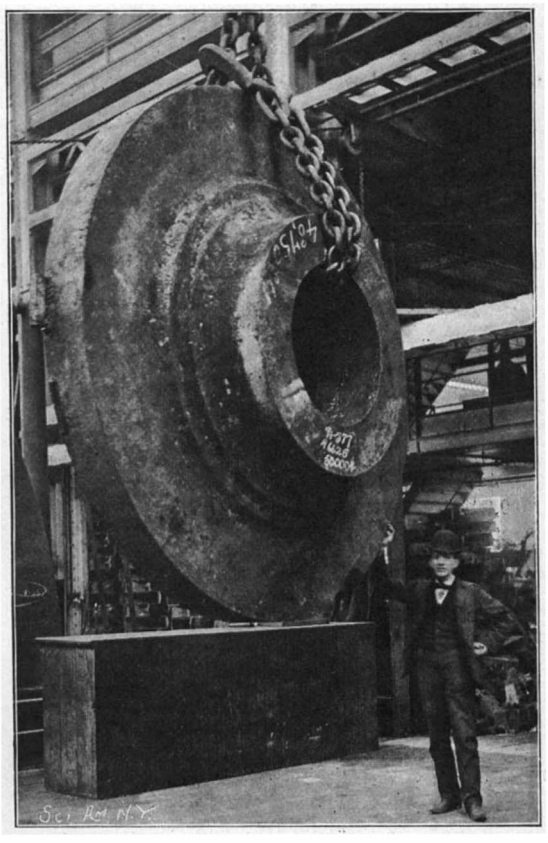


LAUNCH OF THE "MISSOURI."

OPENING THE POWER STATION OF THE MANHATTAN ELEVATED RAILWAY.

In all the history of transportation in New York no event of greater historical significance has happened than the recent starting of the great power station of the Manhattan Elevated Railway Company at 74th Street and the running of the first electrically-equipped trains on Second Avenue. The power station is considerably the largest in the world. It is located between 74th and 75th Streets and the East River, and the combined boiler and engine house is a magnificent building measuring 513 feet on 75th Street and 587 feet on 74th Street, with an even width throughout of 205 feet. The building is of Roman arched construction with classic details and a color scheme of pink granite, brown brick, red tile and buff chimneys, with copper-faced ventilators. Its whole appearance is simple and dignified, and accords with the great size and importance of the plant which it contains. The building is divided into two parts by a longitudinal wall. The northern half of the building is devoted to the boiler plant, and the southern half to the engine plant. The building is of steel, concrete and brick construction, and an idea of its size may be gathered from the fact that it contains 6,000 tons of steel and iron structural work, which is equal to the total amount of steel in the Brooklyn Bridge, exclusive of the cables. To avoid disablement by accident four similar stacks are provided, each being 17 feet inside diameter by 278 feet high. In addition to the main power station there are a series of sub-stations placed at convenient points throughout the city. These stations measure 50 x 100 feet in plan, and contain on the two upper stories the storage batteries and on the lower floors the various transformers and converters. The plant is laid out on a scheme of eight units, each unit consisting of one engine and alternator, four batteries of boilers, one condenser and one boiler feed pump. There are sixty-four Babcock & Wilcox horizontal, water-tube boilers of 500 horse power each. These are carried on two floors, and above them, ranging the full length of the building, are coal pockets capable of holding 15,000 tons of coal. The coal is brought in barges to the dock at the eastern end of the power house, where it is automatically unloaded and carried by conveyors above the coal pockets, into which it is discharged. Similar conveyors automatically remove the ashes. Roney mechanical stokers are used on all boilers. There is one economizer to every two batteries of boilers, and there are sixteen Sturtevant blowers, two on each floor, to be used in cases of emergency due to low barometer, bad coal, sudden increase in load, etc.

The engine plant, which was built by the Allis-Chalmers Company, consists of eight units of 8,000 rated and 12,500 maximum horse power each; and each unit consists of two compound condensing engines, one at each end of the shaft, with the alternator carried at the center of the shaft and between the engines. The high-pressure cylinder, which is 44 inches in diameter, is placed horizontally, and the low-pressure, which is 88 inches in diameter, is placed vertically, the two connecting rods of each engine taking hold of a common crankpin. The two cranks are set at an angle of 135 degrees with each other, an arrangement which gives eight impulses to the shaft at equal intervals in each revolution. On account of the uniformity of rotation thus secured, it has been possible to dispense with the customary flywheel and depend upon the revolving field of the alternator to afford the necessary fly-

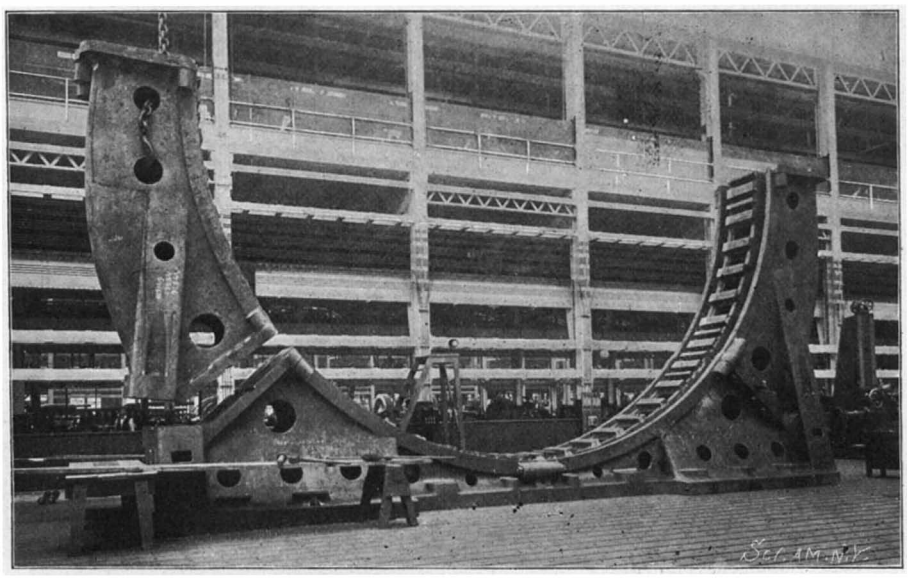


Massive Steel Hub Casting for the Field of the Westinghouse Alternator; Weight 25 Tons.

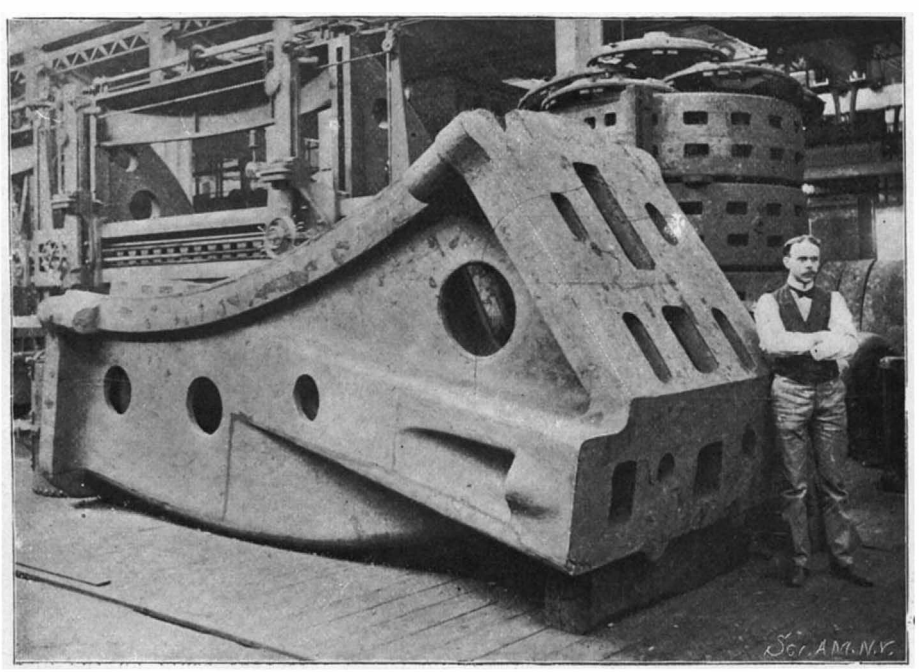
wheel effect. As this field weighs 185 tons, and is 32 feet in diameter, it will be seen that it is well calculated to do this. The common stroke of all the cylinders is 60 inches. The parts of the engine are necessarily very massive; thus the crankshaft, which is 25 feet 3 inches in length, has a diameter at the center of 37 inches and at the bearings of 34 inches, while each bearing is 60 inches in length. There is an axial hole 16 inches in diameter entirely through the shaft. The crankpins measure 18 inches x 18 inches, and the crosshead-pins are 12 x 12 inches. The piston rods are 8 inches in diameter; the steam consumption at the 8,000 horse power rating is 13 pounds per horse power per hour. The valves are of the double-ported Corliss type and they are driven by Reynolds-Corliss gear, there being a separate eccentric for each high-pressure cylinder and separate eccentrics for the steam and exhaust valves of the low-pressure. The weight of each pair of engines is 720 tons, or 180 pounds per rated horse power. The concrete foundations are 40 feet square and 21 feet high. For the present, partly on account of the difficulty of removing the oil from the water of condensation, and partly because of the difficulty of upkeep of the surface condenser, these engines are furnished with ordinary jet condensers.

The system of generation and transmission adopted includes the production of three-phase current by eight large alternators at a single central station, the power being delivered at a pressure of 11,000 volts to three-conductor cables, which distribute it to seven sub-stations, conveniently located throughout the city with respect to the company's lines. At these sub-stations the current passes through step-down transformers, from which it issues as three-phase alternating current at 390 volts potential. It then passes through rotary converters, from which it is delivered as direct current at a pressure of 625 volts to single-conductor cables, which conduct the current from the sub-stations to the third rail with which the elevated roads are equipped.

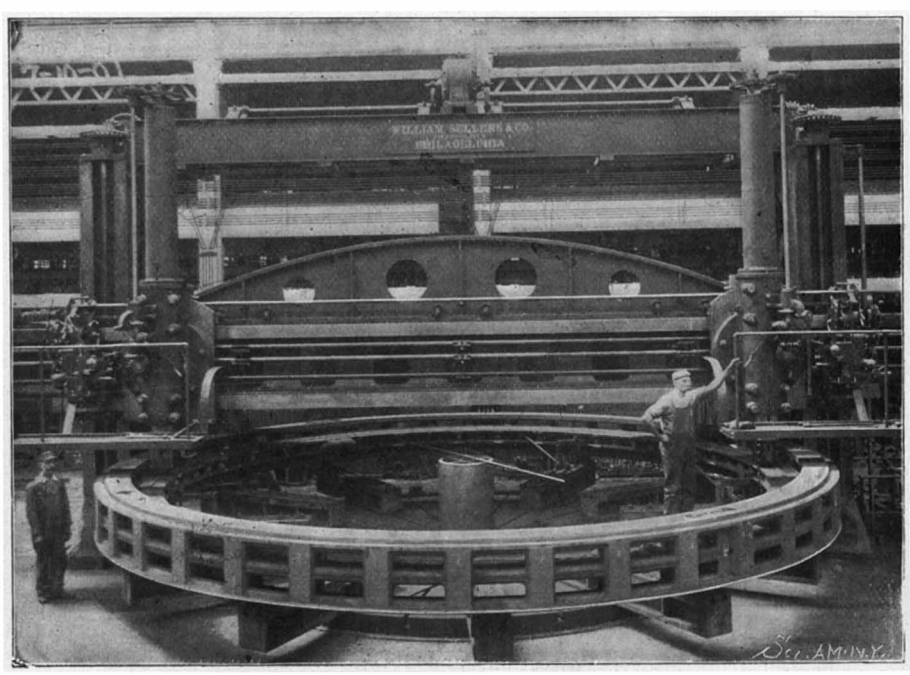
We are informed by Mr. L. B. Stilwell, the consulting electrical engineer of the company, who is responsible for the design of the whole electrical equipment, that in determining the capacity of the power station, it was estimated that at the busiest hours of the day there would be a call upon the station for the delivery to the third rail of 60,000 electrical horse power, the demand varying between this as a maximum, and a minimum of about 5,000 horse power during the early hours of the morning. Among the many alternative plans considered, it was decided to select one which contemplated one large alternating-current power house, located on the East River between 74th and 75th Streets, the current to be generated by eight alternators. These alternators, which are not only the largest yet built in America, but probably the largest ever seriously contemplated for any power station, are, as we have shown, direct-connected to the engine, with the revolving field carried upon the crankshaft. An excellent idea of the huge proportions of the alternator is gathered from the scale offered by the figures shown in our accompanying illustrations, which represent the alternators under construction at the shops of the Westinghouse Electric and Manufacturing Company; but for the sake of greater exactness we give the following dimensions: The foundation plate of the alternator measures 10 feet 3 inches in width by 43 feet in length. From the base of this plate to the top of the yoke which carries the stationary armature is 42 feet, while the width of the yoke, over all, is 4 feet 5½ inches. The cast-steel hub



Fitting the Machined Pieces of the Yoke Together.



A Middle Section of the Yoke.



Driving Rim for the Revolving Field on a 28-Inch Boring Mill—The Largest Mill of its Type in Existence.

MANHATTAN ELEVATED RAILWAY POWER STATION.

for the revolving field weighs 25 tons. The revolving field is 32 feet in diameter and weighs 185 tons, and the total weight of the whole alternator complete is 445½ tons. The external frame or yoke carries the armature windings, which for convenience of construction and handling is built up in six sections. The field poles and the rim of the revolving field are built of thin overlapping plates of sheet steel, each plate having a length equal to the width of two poles, and these plates are dovetailed into the spider, while the rim, the poles and their end-plates are bolted together. The driving rim is carried by two webs of steel plate, which are bolted to the cast-steel hub. It will thus be seen that the parts which are subjected to the heaviest stresses of a mechanical nature are formed practically of nothing but rolled steel. The field winding is made up of copper strap, wound on edge, insulating material being cemented in place between the turns, and the edges of the strap left exposed. The stationary armature consists of a huge cast-iron frame or yoke holding a built-up laminated ring, with slots on its inner face in which lie the windings. The construction of the yoke is shown clearly in our photographs.

The auxiliary equipment of the power house includes the employment of 250-kilowatt multipolar Westinghouse generators as exciters, and three 800-kilowatt rotary converters. There are nine 300-kilowatt transformers and 24 of 75-kilowatt capacity employed for various auxiliary purposes about the system. In the sub-stations there are 26 1,500-kilowatt rotary converters and 78 550-kilowatt transformers.

New Iron Mines at Michipicoten, Canada.

BY W. FRANK M'CLURE.

That the vast iron ore resources of the Lake Superior districts of the United States should find their counterpart just across in Canada is not altogether an unlooked-for development. It has long been a matter of wonderment in this country that Canada has been so slow to investigate the mineral resources of Algoma, in view of the favorable topography of the land, and the existence of the great ore bodies as near as Minnesota and Michigan.

To-day, the same capital from the United States that is building up the giant industries about Sault Ste. Marie, including the water power canals, is opening rich mines at Michipicoten. This will result in Canada becoming the location of her own steel and iron industries. Already this evolution is rapidly progressing, and the Midland, Hamilton and Buffalo furnaces are using ore from the Helen mine, the first of the newly-discovered properties. The new steel mill at the Sault Ste. Marie, when completed, will use the Canadian product exclusively, and four vessels of the Algoma Steamship Company are bringing Helen ore to Ohio ports, from whence it reaches the Pittsburg furnaces. Some 350,000 tons have already been shipped to the United States at a profit in spite of the duty of forty cents a ton.

For shipping the product of these new mines a harbor with extensive dockage has been established at Michipicoten, twelve miles from the Helen mine, and about 130 miles from Sault Ste. Marie.

The Helen iron mine is situated on Boyer Lake. The ore deposit has been exposed to the extent of 28,000,000 tons, and the limit has not yet been found in two directions. The Josephine mine, more recently opened, is in the same belt, but on Park Lake. This mine also is very promising. Then there are the Frances and Brotherton mines on the same range. The output of the new Canadian mines is about 5,000 tons daily, but this will be greatly increased next season. The mining facilities are of the best.

Mr. E. V. Clargue, a brother of Francis H. Clargue, the promoter of all the giant industries in Algoma, is in charge of the ore mining. He found, early in the mining operation, that the bulk of the ore taken from the Helen mine contained an average of about 61 per cent metallic iron and 0.08 phosphorus; also that at the point where the ore body comes to the lake a Bessemer ore is found running as low as .02 to .03 per cent in phosphorus and in sulphur from a trace to .05 per cent. The ore has a high grade in the market, also, on account of its low percentage of water.

The following from a report of Dr. Bell, of the Canadian Geological Survey, concerning the Helen mine, is comprehensive: "The ore is a hard, but somewhat porous or spongy, red hematite, with a specific gravity of about 5. The ore body, from which a layer of muck or peaty moss has been removed, forms a point dividing the head of the lake into two small bays. It has a lumpy surface, with a dark bluish-gray color. Small quantities of brown hematite (limonite) and yellow ocher appear in joints and cavities, but they do not form any appreciable portion of the mass.

"The horizontal dimensions of the exposed ore are about 500 feet in every direction, and its greatest height above the lake is 100 feet. The ground rises steeply all around the head of the lake, so that the ore lies at the bottom of an amphitheater, open on the west or lake side. A drift has been run at the level of the general surface of the ore, southward into the hill, and this penetrates similar hematite for 250 feet, thus giving a known breadth of about 750 feet from north to south. During the winter of 1899-1900, by taking advantage of the ice on the lake, a number of holes were bored in the bottom along a north and south line, which passed the extremity of the point of ore at a distance of 250 feet to the westward. On this line and abreast of the point the lake had a depth of 100 feet, including 10 feet of soft mud, and at 150 feet below the bottom, where the boring ceased, the drill was still in hematite, like that on the dry land. A bore-hole from the surface of the exposed ore was sunk to a depth of 188 feet below the level of the lake without reaching the bottom of the hematite. The ore-mass has thus been proven to have a continuous depth of 300 feet, and as this follows the plane of the bedding, which is vertical, the probability is that the depth is very much greater. The general strike is parallel to the axis of the pond, which is about east and west. The railway approaches the mine from the west along the foot of the hill on the south side of the lake."

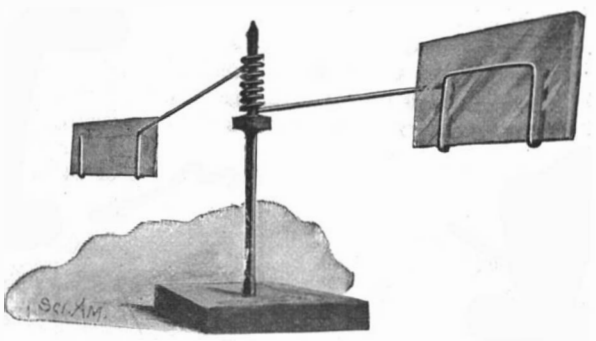
It has been figured by experts that at a shipment of 3,000,000 tons a year it would require a decade to exhaust the ore above ground at the Helen mine. Mining men from Minnesota are taking a great interest in the new territory. They are of the opinion that the deposits there are equal to those of Minnesota.

At Michipicoten harbor, vessels are loaded with ore at the rate of 1,000 tons per hour. Each ore pocket has a capacity of fifty tons. In all there are 500 feet of chutes, and more building.

A CONTRIVANCE FOR COLLECTING ATMOSPHERIC DUST FOR MICROSCOPIC EXAMINATION.

BY THOMAS R. BAKER.

In the accompanying illustration a simple and inexpensive apparatus for collecting atmospheric dust is



AN ATMOSPHERIC-DUST COLLECTOR.

shown, which will probably be of some interest both to bacteriologists and amateur microscopists.

The apparatus consists essentially of a wire, the middle portion of which is coiled into a spiral to fit over and turn on a vertical support. One end of the wire is bent so as to hold a strip of glass, and the other end is bent so as to clamp a piece of cardboard, serving the purpose of keeping the plane of the glass at right angles to the direction of the wind. The support comprises a tenpenny nail driven into a block of lead. Soldered upon the head of the driven nail is the head of a second nail. The heads thus placed in juxtaposition serve as a shoulder upon which the coil of wire rests.

The glass plate is smeared with glycerine upon which the dust adheres. The apparatus can be set in any convenient place where the wind blows, and the plate examined from time to time.

The First Interurban Line in Italy.

The Milan-Monza electric road, which has recently commenced operation, is the first interurban line to be installed in Italy. It is 10.2 miles long, and forms an extension of the Milan tramway lines. The whole system uses the energy furnished by the falls of the Paderno, 20 miles from the city. The interurban line is supplied with current at the Milan end by the tramway station, and along the route it is fed at different points by three lines coming from a sub-station which has been installed at Cesto. Here the 3-phase current from Paderno at 13,500 volts is transformed first to 340 volts and then changed to 550 volts direct current by two rotary converters. The rolling stock comprises 14 motor cars and 10 trailers. The former, which are roomy and of handsome design, have two 50 horse power motors of the General Electric 57 type and carry 48 passengers. The electric equipment has been carried out by the Thomson-Houston Company. This road has only been running for a short time, but it has already absorbed nearly all the passenger traffic between the two cities, which are, however, connected by railroad. As an example of the amount of traffic on the line, it may be mentioned that on special occasions it has carried more than 8,000 passengers in one day, without accident or detriment to the material.

Correspondence.

A Universal Language.

To the Editor of the Scientific American:

Referring to the letter of your correspondent "Arcadius Avellanus" on the above subject, in your edition of December 7, allow me to state that he evidently forgets that the Latin tongue was once practically the universal language of the world, and that was, as every schoolboy knows, in the palmy days of the universal sway of the Roman Empire, when her legions swept everything before them and established themselves as conquerors in all the countries of the then known world.

Now it is fair to presume that that being the case, if the Latin tongue had been able to maintain its supremacy, it would have done so; but any one versed in the grand science of comparative philology knows that the inherent difficulties of Latin—I mean the case endings and the conjugations—have undoubtedly caused its rejection by the people at large as the universal tongue.

With regard to the universality of the English language, which oddly enough seems "unfortunately" to give your worthy correspondent much uneasiness, that is doubtless an established fact; for although on the one hand it is the most difficult language—on account of its irregular orthography—yet at the same time it is the most easy of all the modern tongues to acquire as a means of speech. And I believe any fair-minded, educated person will readily concede the truth of this statement, especially when it must be acknowledged that the children of foreign-born parents "pick up" the English and drop their vernacular even before their entrance into the primary schools.

George Wright.

Observing the Circulation of the Blood.

To the Editor of the Scientific American:

As far as I know from information gathered among physicians of this country (foreign and native), the classical method for observing the circulation of the blood in living animals stands at present where it stood thirty and odd years ago, confined to limited parts of certain organs in the frog and other batrachians, the wings of the bat, the transparent parts of embryos of mammals, etc.

It may be that the means I am to describe has already been applied and been known anywhere out of my notice and that of the physicians I refer to, but if it is still unknown, I hope it will be of some use to students of biological phenomena.

It is about 17 or 18 years since for the first time I had an opportunity of observing under the microscope the embryo of a small fish that swarms in the lake of Managua, in this country. This fish, about 6 to 7 centimeters long, 1 centimeter wide and 5 to 6 millimeters thick, lays its eggs on weeds and roots of plants growing along the lake shores, toward the beginning of the dry season, from November to March. The eggs are spherical, near two millimeters in diameter, transparent, and of albuminous appearance, and are furnished with a few hairy appendices by which they are fastened to the weeds or roots under water, clustered like grapes in bunches of many hundreds and many thousands, tied together. Being so numerous and laid in different days, embryos of different grades of development may be had for observing the circulation of the blood.

The eye catches at a glance a beautiful sight of the whole circulatory system, and follows with delighted attention the stream of blood starting from the heart, running in the arteries and veins, and returning to the heart, whose beatings are conspicuously seen.

The elongated globules of the fish's blood are distinctly seen, forming inside the blood vessels something like a stream of beans. F. J. Medina.

Corinto, Nicaragua, Central America.

The Current Supplement.

The current Supplement, No. 1358, is opened with the second installment of a most interesting illustrated article entitled "The Building of a Modern Locomotive." "The Jig Habit in America" is by Oberlin Smith. "Practical Building of Lowland Protections" is continued. "The Position of the Engineer in Municipal Service" is by Alex. Dow. "Direct-Driven Continuous-Current Generators for Lighting and Power" illustrates a large direct-driven generator. An abstract of the Report of the Secretary of Agriculture is most interesting. "The Silent Chain Gear" is by J. O. Nixon.

According to Commercial Intelligence there is an immense future for the development of motor-van traffic in Italy. Ten days is the average time for goods by a slow train from Milan to Genoa, a distance of one hundred miles. Motor cars that could do the distance there and back in twenty-four hours would never lack a full load.

Official Tests of Alcohol Motors.

BY OUR PARIS CORRESPONDENT.

An interesting series of tests of alcohol motors has been recently carried out at Paris by a commission of experts under the patronage of the Minister of Agriculture. The object of the tests was to find out as nearly as possible the present status of the alcohol motor, both in the stationary type and especially as applied to automobiles. The competitors for the latter class were advised to look for a good all-around vehicle, and not seek for exaggerated speeds. Most of the motors used a 50 per cent mixture of alcohol and gasoline or other carburetant, while some used pure alcohol. The fixed motors were put through a series of tests at the Agricultural Testing Station at Paris, with indicator and brake. Each had generally three tests, one with no load for quarter of an hour, one at half-load for one-half an hour, and one at full load for one hour. The constructors furnished data as to diameter and stroke of piston, compression volume, flywheel, etc., besides general dimensions and drawings. The following measurements were made: 1. Power, effective and indicated. 2. Revolutions per minute. 3. Number of explosions per minute. 4. Regularity of running. 5. Time required for starting. 6. Consumption and heating of refrigerating water. 7. Consumption of alcohol per horse power. 8. Ignition. The following table gives a few specimen data out of the large number of motors tested, from 2 to 16 horse power. The general value of the motor is indicated by a certain number of points of merit, of which the maximum is 200. These depend upon the following conditions: Proper utilization of alcohol; this is defined by the product of the consumption per effective horse power and the percentage of carburetant in the liquid. Thus a motor is better as it uses a smaller amount of liquid as well as one richer in alcohol. Another point is general good working under normal load, regularity, etc., also its performance under variable loads, then ignition and ease of starting, general construction, simplicity and keeping in order. In the table for alcohol consumption it should be observed that all the figures are brought to the basis of a consumption of 50 per cent alcohol for the sake of uniformity. The liquids were analyzed at the Pasteur Institute laboratory.

The most valuable tests are those of the automobiles, shown in the following tables, which give the consumption of alcohol under actual performance on the road and upon the track. In making these tests the automobiles were taken from Paris over about 60 miles of route in the neighborhood. This course included a test upon the race-track of the Agricultural Park at Achères, about midway on the route, in which the machines were run at about 20 miles an hour over the track, and their performance and consumption of alcohol noted.

ALCOHOL AUTOMOBILE TEST TABLE.

	Horse Power	Weight		Mean speed on track.	Nature of alcohol	Consumption of alcohol in cubic centimeters per ton-kilometer		Points of Merit.
		Empty	Loaded	Kilom per hour		For total course.	On track	
1st Section.—Moto-cycles and light vehicles up to 250 kilogrammes.								
M. Lamaudière (motocycle)	1¾	54	134	38.0	50%	158.1	214.5	161
Darracq & Co. (quadricycle)	3¼	205	350	37.2	pure*	195.7	223.7	151
2d Section.—Voiturettes of 250 to 400 kilogrammes and vehicles from 400 to 650 kilogrammes.								
Geo. Richard Company (1 cylinder)	4	426	712	34.0	50%	110 7	129.9	185
Darracq & Co. (" ")	6½	493	846	34.4	50%	118.3	102.0	177
Delahaye Company (" ")	6	623	931	31.0	pure*	137.5	122.9	172
Gillet-Forest & Co. (" ")	5	593	709	31.2	50%	140.0	132.2	163
Gladiator Company (" ")	6½	532	820	32.6	50%	137.5	129.6	160
3d Section.—Vehicles of 650 to 1,000 kilogrammes and over.								
Delahaye Company (2 cylinders)	7½	1,042	1,352	35.8	50%	95.15	93.15	187
Bardon	5	840	1,105	28.8	pure*	96.15	82.9	183
Vilain (1 cylinder)	6	766	1,070	30.8	pure*	98.2	114.0	177
Société Nancéenne (2 cylinders)	12	960	1,250	33.3	50%	115.8	82.16	172
Martha	9½	1,195	1,540	33.2	50%	122.5	108.36	170
Gobron-Brillié (2 cylinders)	14	1,094	1,477	42.8	50%	123.8	135.4	167

	Horse Power	Weight Kilogrammes.		Load carried kilom.	Mean speed over total course.	Nature of alcohol	Consumption for total course		Points of Merit.
		Empty	Loaded				Average per ton kilom.	Per ton kilom. of load.	
4th Section.—Industrial vehicles, delivery wagons, tractors, etc.									
Société Nancéenne (large hauling wagon) 2 cylinders	10	2,506	5,877	3,371	9.1	50%	96.3	167.8	194
Panhard & Levassor (hauling wagon) 4 cylinders	8	2,300	4,640	2,340	7.6	50%	119.7	237.3	179
Panhard & Levassor (small hauling wagon) 2 cylinders	6	1,020	1,933	913	14.45	50%	105.6	223.6	179
Bardon (delivery wagon)	4½	968	1,430	462	14.9	pure*	92.4	286.1	170
Gillet-Forest & Co. (small hauling wagon) 1 cylinder	6	660	1,402	742	16.7	50%	144.1	272.2	179
Peugeot Company (postal wagon)	4½	720	924	204	15.4	50%	183.6	831.4	166
De Dietrich & Co. (large delivery wagon)	9	1,340	2,396	1,056	8.6	pure*	321.2	728.7	149

*Figures brought to a basis of 50 per cent alcohol.

This series of tests was followed by an exposition of alcohol motors, automobiles, lighting and heating apparatus, in the Grand Palais, lasting from the 16th to the 24th of November. It was formally opened by President Loubet, who, it is well known, takes a great interest in the utilization of alcohol and the development of this national industry. Some of the leading features of the exposition will be described in a subsequent article.

Report of the Secretary of Agriculture.

The Fifth Annual Report of the Hon. James Wilson, Secretary of Agriculture, is considerably larger than former years, extending over some 113 pages. It reflects the growth and development which has attended this important department of the government, and urges Congress in the strongest terms for appropriations which will enable the Secretary to obtain the best men who can be found to fill the important positions in the Department.

The Department of Agriculture has reached farther than ever into sympathy with the industries of the people during the past year. It has identified itself more intimately with the experiment stations of the several States and Territories and what pertains to the interests of their people. It has gone farther in foreign lands to find many things that will be valuable to our producers. The grouping of related sciences into bureaus has economized time and contributed to efficiency. The process could be advantageously extended to other divisions and offices that are growing beyond their present environment. The education of student assistants and scientific aids in their several specialties goes on satisfactorily under the scientists in charge, giving promise of high efficiency in the future personnel of the Department.

The forecast field of the Weather Bureau is extended, and it now includes reports from certain points in the British Isles and on the continent of Europe, from the Azores, Nassau, Bermuda and Turk's Island. The Atlantic forecasts which are based upon these reports now form part of the regular forecasts which are issued at Washington. The extension of the forecasts to farmers through rural free delivery is contemplated. Important experiments in wireless telegraphy have also been carried out under the direction of the Bureau. The total export of animals and animal products during the year exceeded $250,000,000, and this great foreign market is only preserved by the efforts of the Department and the rigid inspection which is exercised through the Bureau of Animal Industry, which inspected for export 385,000 cattle, 228,000 sheep and 48,000 horses and mules and nearly 1,000 vessels carrying live stock. Imported animals to the number of 342,000 were also inspected. The inspection service involved the examination at time of slaughter of nearly 37,000,000 animals. The Bureau of Plant Industry has brought together in one group investigations in plant physiology and pathology, botany, grasses and forage plants, pomology and experimental gardens and grounds, including the experimental farm at Arlington, and the introduction of foreign seeds and plants. Investigations in plant physiology and pathology have been devoted to the study of cotton diseases, diseases of orchard fruits and forest trees and construction timber. Good work has been done in botanical researches with special reference to seeds, the improvements of crops and the methods of crop production in our tropical possessions and the prevention of losses of cattle in the West by eating poisonous plants. Four thousand five hundred pounds of high grade tea was grown at Summerville, S. C., during the year. Great activity has characterized the introduction of valuable seeds and plants from abroad. During the last three years the Department has introduced Japanese rice, and our imports of this product have decreased from 154,000,000 to 73,000,000 pounds. Macaroni wheats have been introduced in the past two years very successfully into the Dakotas and also into Kansas and Nebraska. Progress is reported in the introduction of Egyptian cotton. The imports of this product now amount to $8,000,000 yearly.

The Division of Soils has recently been made a bureau and has received increased resources, which enable it to extend its scientific investigations as well as its practical operations. The area surveyed and mapped during the year exceeds 3,500,000 acres, making a total of nearly 6,000,000 acres surveyed during the past two years. The experiments made by the bureau in the growing of a fine type of Sumatra leaf in certain soils in the Connecticut Valley have been most successful. The Bureau of Chemistry has carried on investigations on the composition, lucrative value and adulteration of food products, the work of the year being specially devoted to the study of preserved meats. The work that the Bureau of Chemistry is doing for other departments of the government is considerable and is constantly increasing.

Among the newly organized bureaus is that of Forestry, and this bureau is co-operating with several States and many private owners in their handling of forestry lands. Assistance has been asked for the handling of forestry lands. And the inspection has been asked for 52,000,000 acres. During the year nearly 800,000 acres under private owners were examined by official representatives. The Office of Experiment Stations reports that the work of the stations is becoming better understood by the farmers, and that a broader and deeper foundation of scientific inquiry is being made each year, and the value of this co-operative method to the agricultural interests is very generally acknowledged. An increase in college extension work in agriculture is noted, and stress is laid on the movement for the establishment of secondary schools of agriculture and the introduction of the elements of agriculture into the rural schools. Dietary studies and experiments in cooking, digestion and metabolism have been conducted in various parts of the United States in co-operation with experiment stations, agricultural colleges and universities. The results of these investigations should, in the opinion of the Secretary, be practically and beneficially applied to the feeding of men wherever a considerable number of persons are to be fed on a systematic plan. The report devotes considerable space to the discussion of irrigation investigation.

The Division of Entomology has been very active during the year in carrying out work along several lines. The division is now ready to supply fig-fertilizing insects to any grower after he has succeeded in raising to the bearing stage the Caprifig and Smyrna fig trees. A natural enemy of the San José scale has been discovered in a ladybird beetle, and steps will be taken to acclimate this important species. The Biological Survey is engaged in mapping the natural boundaries of the crop belts of the country. A fiber plant closely related to the Mexican Tampico plant has been found growing in great abundance over a large part of the Sonoran zone. The Texas species is likely to prove of considerable value. The Survey is now conducting experiments in the Dakotas, Nebraska, Kansas and Texas with a view of destroying prairie dogs. The Survey is charged with carrying out the provision of the Lacey Act and other game laws. Good work has been done by the Division of Statistics and the office of Public Road Inquiries and the Division of Publications. During the year 606 separate publications aggregating nearly 800 copies were issued by the division. A special building has been rented to be devoted exclusively to the storage and shipment of Farmers' Bulletins, of which no less than 7,000,000 will have to be printed this year.

The highest record which has been previously attained in the export of agricultural products (1898) was surpassed by over $90,000,000, when a value of over $950,000,000 was reached. Of the merchandise sent abroad during the year, 65 per cent originated on the farm. Of foreign customers, the United Kingdom takes nearly 50 per cent of our agricultural products exported. Our imports of agricultural products from Cuba, Porto Rico and the Philippines exceeded our exports by $30,000,000. An abstract of the Annual Report of the Secretary of Agriculture will be found in the current issue of our SUPPLEMENT.

MAKING ROADS BY MACHINERY.

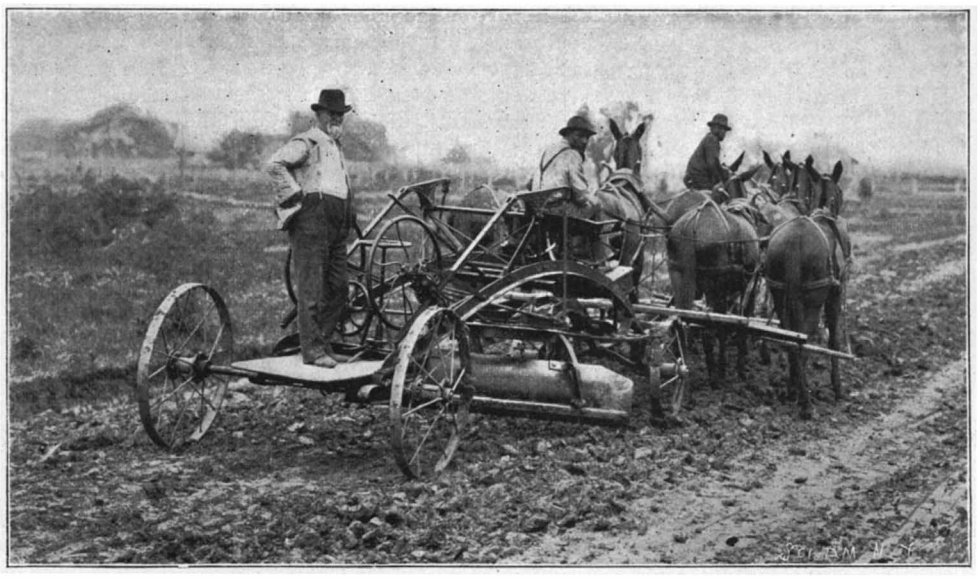
BY WALDON FAWCETT.

The immense number of crude and frequently impassable roads to be found in all parts of the United States and the serious extent to which they have handicapped the marketing of farm products in various sections of the country lend especial significance to the crusade in favor of good roads which is being conducted by the Office of Road Inquiry, a division of the Department of Agriculture. As yet there have not been secured appropriations of sufficient size to enable the government to undertake on its own account the provision of better highways, but this will come in time, and meanwhile highly important results are being accomplished solely by the presentation of forceful object lessons.

The investigations of the Office of Road Inquiry are mainly directed in seven general fields, namely: to ascertain as nearly as practicable the actual cost of bad roads and the benefit of good roads; to demonstrate the interest of cities and towns and the owners of property of all kinds wherever situated, in the improvement of country roads; to develop the methods whereby all of these interests may co-operate with the farmers in the work of road improvement; to discover what actual and systematic road improvement is being carried on in any part of the United States, and how the same or modified methods may be applied to other sections; to discover road materials in various sections of the country; to discuss new plans for road construction and encourage experiment in this direction and, finally, to actually construct sample roads.

The governmental experts have incidentally devoted much attention to the subject of wide tires; have investigated the use of convict labor in road construction, and encouraged the organization of State and local road associations. In this connection many important experiments have been made to test the power required in hauling over various kinds of roads. The government has learned, too, by consultation with many thousands of the most intelligent farmers of the country that the expense of moving farm products and supplies averages on all the American country roads 25 cents per ton mile, whereas the charge in the good roads districts of this and other countries is less than one-third that amount. This extra expense amounts in the aggregate to more than the entire expenditures of the national government, and taking into account all of the hauling done on the public roads the loss is equal to one-fourth of the home value of all the farm products of the United States.

Probably the most interesting phase of the work has been found, however, in the construction of specimen roads of various kinds in different parts of the country. Ordinarily three styles of road have been represented in this experimental work—a modern macadam, a sand and a dirt road. Of these three the macadam highway is the most interesting from the point of construction. After a uniform grade has been secured by the use of wheeled scrapers, drag scrapers and plows, and possibly road graders as well, there are placed upon this foundation three separate layers of the best quality of stone that is procurable in the vicinity. The foundation course, which is about five inches in thickness and made up of two and one-half inch stone, is thoroughly rolled before the second course, composed of one and one-half inch stone, is put on, and this layer in turn is sprinkled and rolled before the surface layer or "binder," as it is commonly called, consisting of three-quarter inch stone and dust, is put in place.



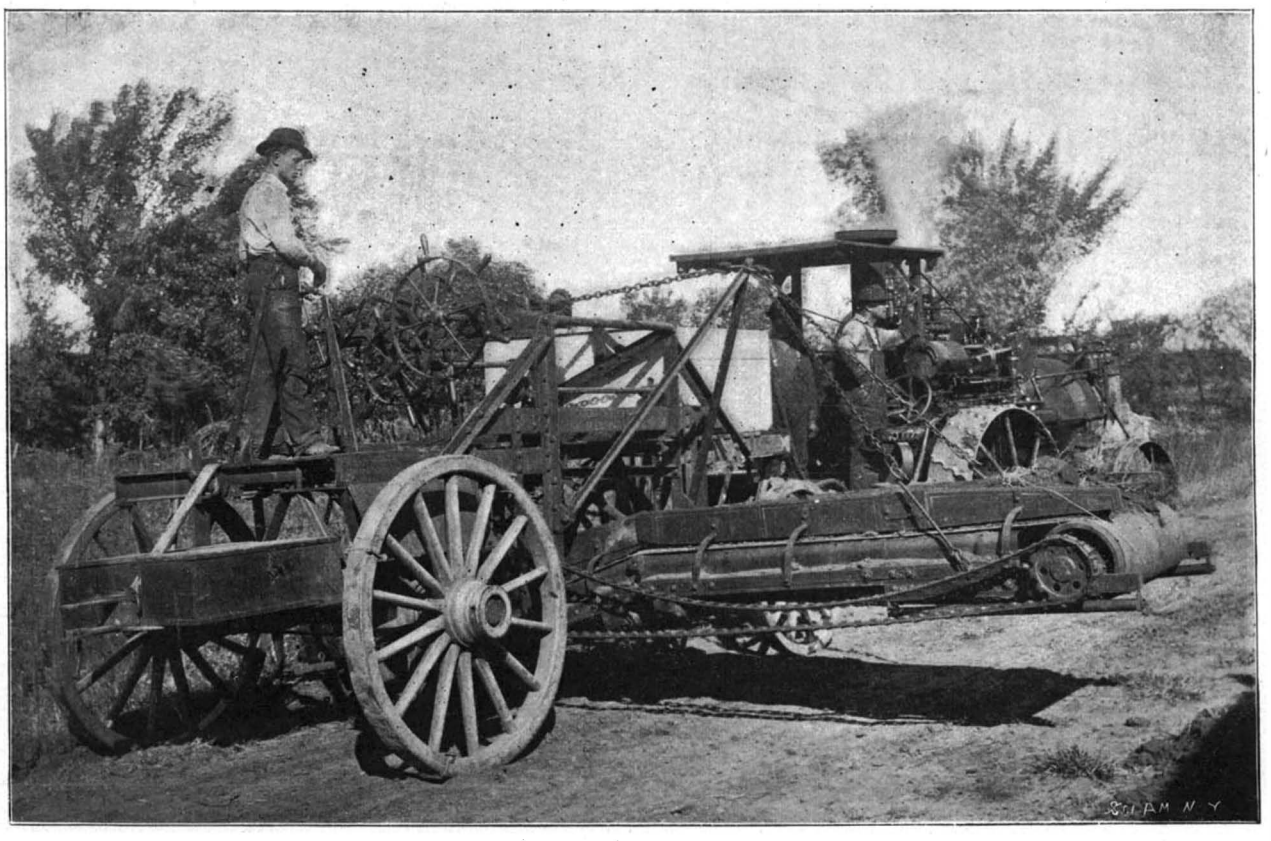
Road Scraper at Work.

The sand road is formed by placing six inches of river sand on a bed of natural clay, neither the bed nor the surface of the road being rolled. The dirt road is made by grading in the usual manner. As a rule neither of these latter classes of highways is constructed save to demonstrate the superiority of the macadam road. Considerable attention has been given to the construction of steel-track wagon roads—decidedly the most novel type of highway yet introduced in any country. The steel road might be compared to a street car track of modified design, and the plan for its utilization was doubtless suggested by the well-known tendency of teamsters to make use of urban and inter-urban trolley and cable lines on highways where locomotion would otherwise be difficult.

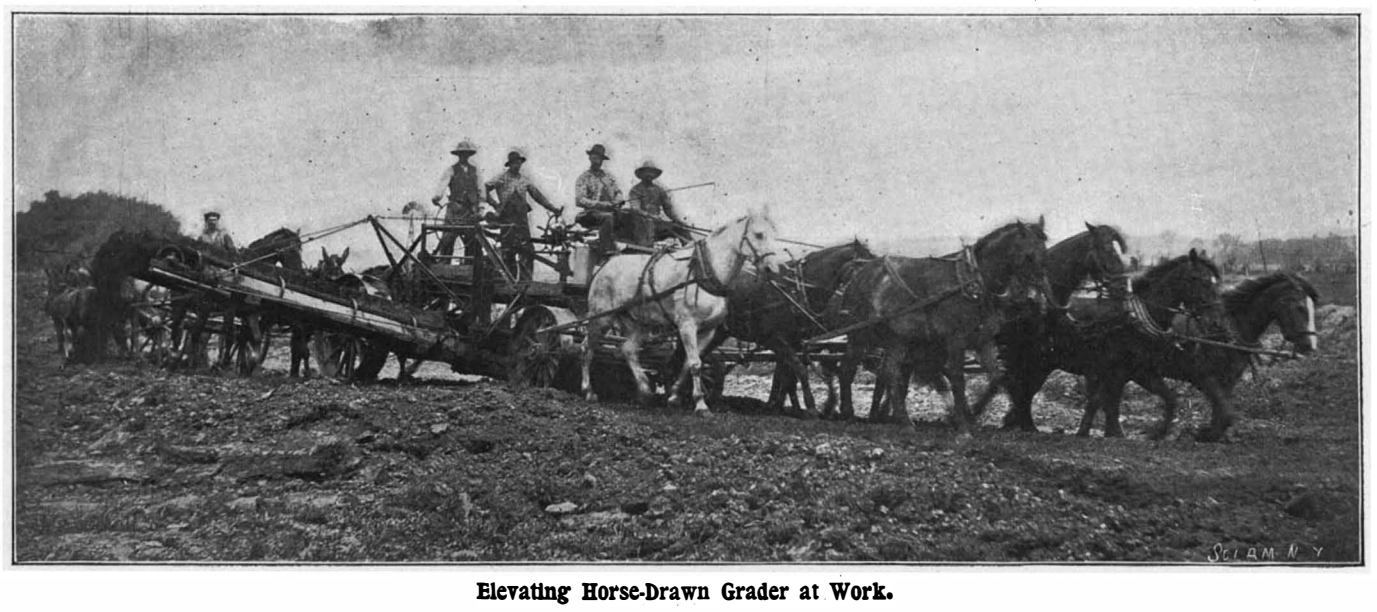
The steel-track wagon road consists of two parallel lines of steel plates or rails each eight inches in width and not supported on wooden cross-ties but simply made solid in the road by flanges projecting into the concrete of the roadbed. The rails are accurately spaced so as to receive the wheels of all vehicles of standard gage without regard to the width of tire, and each plate or rail is fitted with a flange on the inner side to prevent wheels from easily leaving the tracks. Unique roads of this type have been constructed in half a dozen different States, and in some instances the records made upon them have been little short of marvelous. In one instance a load of eleven tons which required twenty horses for its movement over an ordinary road was readily drawn along the steel track by a single horse. This load was twenty-two times the weight of the animal, but at Ames, Iowa, recently a horse started and moved on a steel-track highway a load fifty times the weight of the animal. It may be noted that the cost of the steel-track roads has ranged from $1,500 to $3,500 a mile, according to the original condition of the roadbed.

The extension of the good roads movement has resulted in a corresponding development of the engineering operations involved and of the machinery employed. Possibly the most interesting of all the forms of special apparatus which have been introduced for this work is the elevating grader which is utilized in reducing cuts several feet in depth. This machine elevates earth and drops it into wagons alongside, loading a wagon in twenty seconds. On an average such a machine will load into wagons in one day of ten working hours from 700 to 800 yards of earth.

The elevating grader is very heavy, and about twelve horses are required for its movement, some of the animals pulling and others pushing. The operating force consists of three drivers and two machine operators, one of the latter looking after the plow and the other giving attention to the elevating conveyor. The plow of this machine makes a cut twelve inches square. After a grade has been reduced a machine of this type may be employed if desired to elevate dirt to the center of the



Grader Drawn by Traction Engine.



Elevating Horse-Drawn Grader at Work.

MAKING ROADS BY MACHINERY.

road, from whence it is distributed by graders of the ordinary type.

The construction of macadam roads on a large scale has naturally imparted a great impetus to the development of rock crushing apparatus. The first steel rock crusher was built ten years ago and a gradual improvement has since gone hand in hand with an increase of capacity. The most modern plants not only crush the stone but elevate it and separate it into sizes. The stone crushers weigh from two to eight tons each, require for their operation engines of from twelve to twenty-five horse power and give a product of from eight to thirty tons of crushed stone per hour. For separating the crushed stone into different sizes road makers usually use a portable storage bin which weighs 2,500 pounds and has three compartments, each of which will hold four tons of stone and which are provided with discharging chutes on either side so that wagons can load from both sides if necessary. For separating the crushed material into various sizes screens of different types are available. One of the most interesting forms of this apparatus is the revolving screen, which revolves on either a shaft or on rollers and into which the stone passes. Some of these screens are fifty-six inches in diameter, and inasmuch as each screen is punched with holes of two different sizes, three different sizes of product are obtained, one size passing through the one-inch holes, a second size passing through the two-inch holes, and the largest size passing out at the end of the screen.

Another class of machine in which great improvement is noticeable is the steam road rollers. The principle on which the newest machines are constructed is to make the wheels, which are absolutely necessary to carry the machine, act as the rollers proper. Road rollers range in weight from five to nineteen tons, and on the larger sizes the driving wheels are about 76 inches in diameter and have a facial measurement of from twenty to twenty-six inches. Rapid road building is still further facilitated by the use of spreading wagons, dump wagons, road plows and other improved forms of apparatus which are largely automatic in their operation and which contribute to an economy of time and money.

THE NERNST LAMP.

The Nernst lamp, as commercially developed by the Nernst Lamp Company, of Pittsburg, Pa., a Westinghouse interest, while not as simple in construction as the incandescent lamp, is much less complex than the arc lamp. Like the incandescent lamp, the radiating body is a filament heated by the passage of a current, either alternating or direct. The filament is a composition formed by mixing rare earths with a highly infusible body. As is well known, rare earths when heated to the approximate temperature of the incandescent lamp give a blinding, brilliant light, comparable in whiteness with the lime light or carbon in an arc. The quality of the light is remarkable for its beauty and close approximation to daylight, giving to colored objects their true appearance. This property makes the lamp especially desirable in stores, art galleries, drawing-rooms and the like. The absence of shadow, the steadiness of the light, the simplicity and low cost of maintenance,

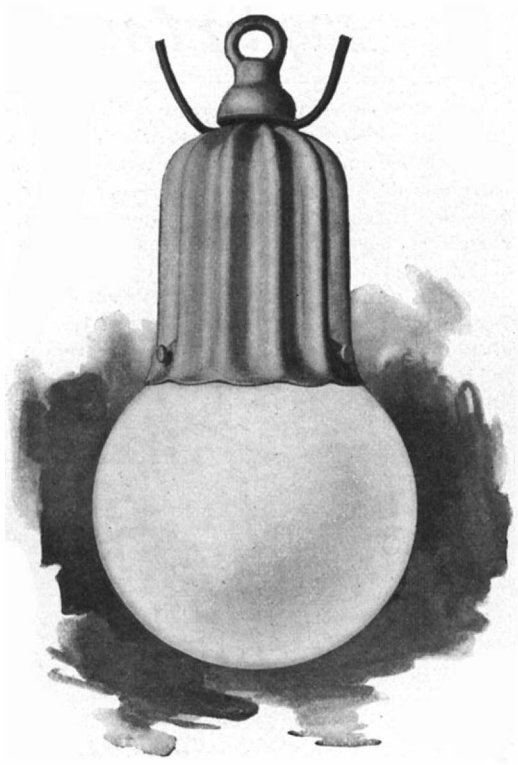


Fig. 5.—Six Glower Lamp—Out-Door Type.

together with its high efficiency, commend the Nernst lamp strongly to the lighting world. Depending as it does solely upon the heating power of the current, it can be used on circuits of 3,000 alternations. This

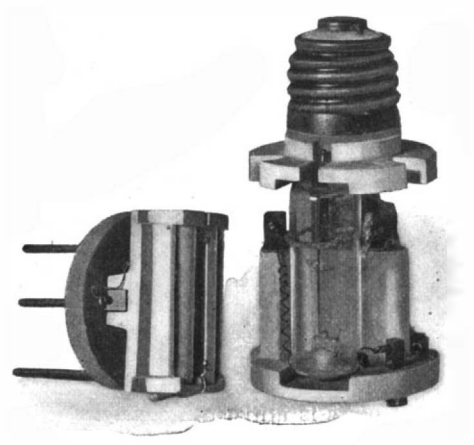


Fig. 3.—Parts of the Single Glower Lamp.

more than any other fact will cause it to displace the arc lamp.

The incandescent filament is a non-conductor at a low temperature, and therefore some device must be employed to raise its temperature before current can pass through it. Accordingly, a platinum resistance called a "heater" is provided for bringing the filament to a conducting temperature. The peculiar behavior of the filament or "glower," as it is commonly called, with reference to voltage and current, has given rise to the necessity of a steadying resistance. As the current in the glower is increased, the voltage across its terminals rises; at first rapidly, and then more and more slowly to a maximum, beyond which it again drops off with increasing rapidity as the current and resulting temperature through the glower continue to increase. Beyond the point of maximum voltage the decrease in resistance of the glower is so rapid as to make the current difficult of control. In fact, without the employment of a steadying resistance the conducting filament would rapidly develop a short-circuit and flash out. This tendency is counteracted by placing a steadying resistance, or "ballast" as it is called, in series with the glower. Such an arrangement keeps two points, between which is the glower and steadying resistance, at a constant potential and consequent steady current; in other words, the steadying resistance as placed in the actually constructed lamp rises in temperature and increases in resistance by as much as the glower diminishes. There are then three elements to be described—the glower, ballast and heater.

The glower for a 220-volt lamp is about 25 millimeters long and 0.63 of a millimeter in diameter. It is made by expressing from a die a dough made of the rare earth mixed with a suitable binding material, cutting the porcelain-like string thus made into convenient lengths, drying, roasting and finally attaching lead-in wires. Embedded in the ends of the glower are platinum wires ending in beads, so that any tendency on the part of the glower material to shrink—repeated heatings produce this effect; clay is the common substance that exhibits this property—can only result in tightening the contact, and maintaining intimate union between the platinum bead and the glower. To the platinum beads are fused short lead wires of platinum, to which in turn are fastened conducting wires ending in aluminium plugs. A bundle of the glowers is shown in Fig. 1. The glower is about as strong as a piece of porcelain of the same size, and it is difficult to break a short section. When properly made the voltage of the glower changes but slightly during its life, the tendency being to rise from two to four per cent in eight hundred hours.

It has been mentioned that the use of a steadying resistance is to keep the current in the filament constant; it must, therefore, act immediately or it is useless. As designed to meet this exacting requirement it is unique in construction and wholly effective in keeping the glower at a constant temperature. Iron wire is mounted in a small glass tube filled with an inert gas, so that no matter what temperature the iron takes it will not be affected. It would oxidize were not the air in the tube replaced by a chemically inactive gas. One of these is employed for each glower.

As already mentioned, the glower is non-conducting when cold, and means must be provided for bringing

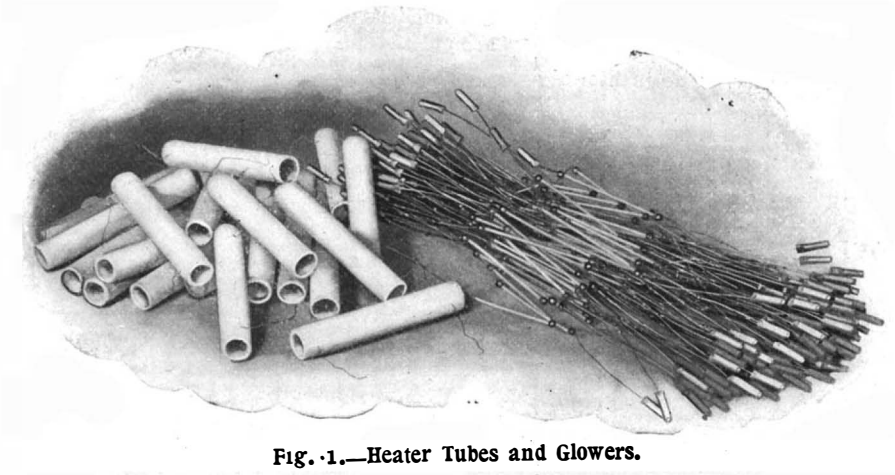


Fig. 1.—Heater Tubes and Glowers.

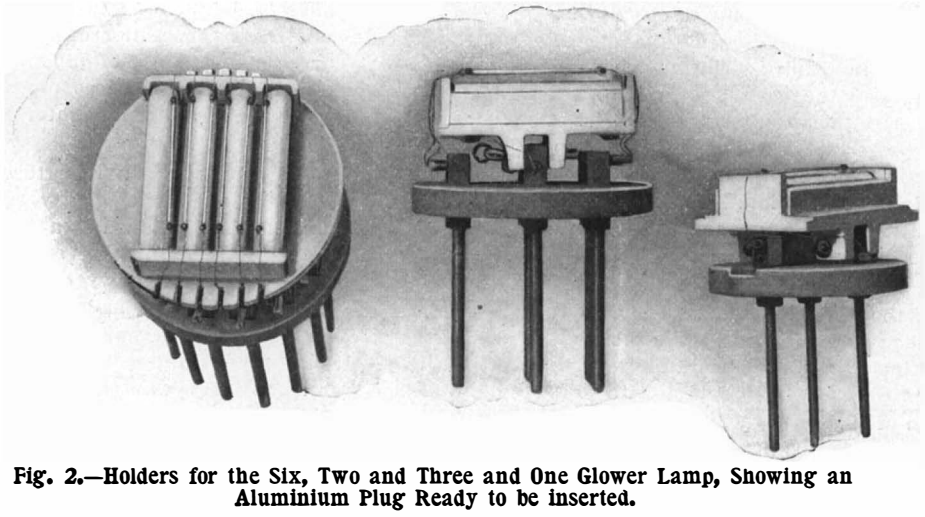


Fig. 2.—Holders for the Six, Two and Three and One Glower Lamp, Showing an Aluminium Plug Ready to be inserted.

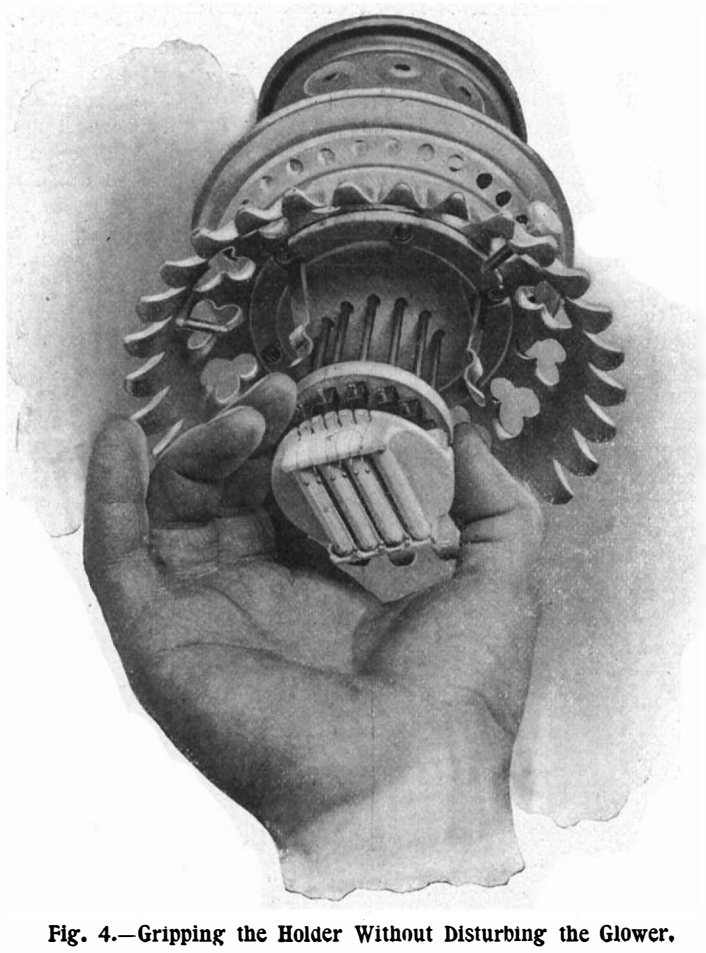


Fig. 4.—Gripping the Holder Without Disturbing the Glower.

it to a conducting temperature. The heater as now constructed consists of a thin porcelain tube, overwound with a fine platinum wire, pasted with cement, the latter serving to protect the platinum from the intense heat of the glowers. These tubes are wound for 110 volts and are connected in pairs of two in series according to the service; the one, two and three-glower lamps taking one pair, and the six-glower two pairs. These heater tubes are mounted on a porcelain support in such a manner as to be readily accessible. The life of the heater is surprisingly long; in fact, is so lasting that it cannot be considered as a repair part. Fig. 1 shows a number of heater tubes. In Fig. 2 the left-hand illustration shows four heaters and the overlying glowers in close proximity.

The lamp is automatic—a necessity in the lighting world. It requires a cutout to disconnect the heater from the circuit as soon as the glower shall have lighted. The cutout is a magnet-coil which actuates a pair of keepers, breaking the circuit. From the position in which the cutout is placed in the lamp it must operate at rather a high temperature and without possibility of failure. It must, therefore, be heat-proof, the contact must not weld, and the moving member should not hum on alternating current. Severe as these requirements are, they have been met in a most effective and satisfactory manner by embedding the coil in cement, by making the contact of silver, and by suspending the moving member from a single point of support.

The lamp is suspended by an I-bolt, which being removed allows of immediate access to the inner part of the lamp. On removing the I-bolt the housing comes off and we find the steadying resistance-bottles placed in a semicircle around the cutout. The connections are made with small aluminium plugs on the ends of the inner connecting wires, a procedure which avoids the troublesome setscrew. All parts are mounted on porcelain; in fact, the lamp contains no combustible material whatever. The heaters and glowers are attached to a removable piece or "holder." The design is such that the heaters backed by a porcelain disk are immediately above the glowers, a disposition of parts that is conducive to efficiency in service. The glowers and heaters are attached to the binding posts of the holder by means of small aluminium plugs. The holder carries the heaters and the glowers. Electrical contact is provided for these by contact-prongs, which, when the holder is pushed up into the lamp, automatically makes the desired connections. A small glass globe, called the heater-case, is held by spring clamps around the glowers, and serves to retain the heat and thereby decreases the efficiency of the glower. The lamps are made of from 50 to 2,000 candle power. There is one glower in all lamps of 50 candle power, and the number increases up to 30 for the 2,000 candle power.

Engineering Notes.

Two compressed air cars have been placed in service on the North Clark Street line, Chicago, Ill. They are used after 1 P. M. when the cable stops running. The reservoirs in these cars are charged to a pressure of 2,500 pounds to the square inch. The working pressure is 150 pounds to the square inch. The cars are charged on every downtown trip.

The much-discussed question of American versus English locomotives, which occupied a great deal of attention the past summer, is dismissed, for a time at least, by The Engineer, London, in these words: "In the United States economy of fuel is a secondary consideration. There has been a large consumption of oil, and rather heavy repairs because the workmanship is not equal to that of British locomotives, nor does it pretend to be. In a very short time trouble will begin with the fireboxes because of the intense combustion required to make steam, but there is nothing inconsistent in this with American practice. The engines were very cheap, they have done their work, and have tided the company over by prompt delivery, but it is unfair to compare them with English locomotives made to use little coal and oil, to last long and require few repairs. Probably price for price, the American engines are as good as anything that can be made in this country."

English railway men recently visiting us say that there will have to be a great change in their own management as regards loads hauled by one engine, citing the case of American engines pulling 1,500-ton loads as against their own with capacity for only 300 tons. Fifteen hundred tons is no load for an American engine built for the work; more than double this quantity has been hauled at 15 miles per hour by engines built at Schenectady. As to the heating surface of American engines, it was thought that the limit had been reached in these same engines, 3,500 square feet, but the "Soo" line is having 74 "decapods" built which will be the largest in existence, weighing 236,000 pounds, with 5,400 and 5,800 square feet of heating surface.

Prof. Rowland's Telegraphic Inventions.

The late Prof. Henry A. Rowland filed in the United States Patent Office applications for patents on telegraphic improvements, which have recently issued.

The one invention provides an improved method of transmitting messages over an alternating-current circuit by selecting for each signal or character a predetermined number of the current impulses and modifying them by changing their polarity, but otherwise maintaining their form and characteristics. Prof. Rowland also contemplated the division of the line current impulses into groups, each of which corresponds to a character or signal. A predetermined number of the impulses are reversed in sign, the order and relation of the reversed with respect to the normal impulses of a group determining the signal or the character of the code. In carrying out this invention a mechanism is introduced into the alternating-current circuit by which the connections of the source of alternating currents may be reversed at any moment, so as to reverse the polarity of any desired impulse or any number of impulses. By reversing the wave instead of cutting it out, as Prof. Rowland formerly did, two or more adjacent impulses of a group may form a combination when received upon a polarized relay—a result which could not be obtained with the cut-out wave.

Another invention of Prof. Rowland's is a multiplex printing telegraph of the synchronous type, in which the local transmitting and receiving instruments are controlled by synchronously-operating mechanism. The system is adapted to be used with an alternating line-current, which is employed both for transmitting signals and for producing synchronous motion. The advantages to be derived from such an adaptation of the alternating current are many. An alternating current can be sent over a line to a greater distance without any change of form of its waves or impulses than any other current. Consequently messages can be transmitted to great distances without relaying or repeating them. Moreover, there will be practically no diminution of speed with increase of distance. The synchronous motion is produced by and maintained between continuously moving or rotating parts as contradistinguished from the intermittent motion of "step-by-step" telegraphs. In Prof. Rowland's invention the inertia of the moving parts is utilized in steadying their motion and in maintaining synchronism, whereas in the step-by-step devices the inertia is entirely gotten rid of, so that if for any reason the current which operates the step-by-step devices should be interrupted, the motion of these devices would be arrested accordingly.

Prof. Rowland also invented an improved form of printing machine by which telegraphic signals can be translated into typographical characters and printed in page form on sheets of paper. The paper upon which the characters are printed is delivered to the printer-carriage either from a roll, in single sheets, or in any other convenient manner. The printer-carriage, actuted by suitable spacing mechanism, moves the paper step-by-step under a continuously-rotating type-wheel until the end of a line is reached, when, by the operation of a lining mechanism, the paper is fed up, a new line is formed, and the carriage is returned to its original position. The carriage may, however, be caused to reverse its motion or return to its original position at any desired point of its travel. The characters are printed by an electrically-operated platen, which is caused to strike the paper and bring it in contact with the proper character on the type-wheel for each combination of signals received. In order to accomplish this, as well as to actuate the spacer, liner and other electrical devices of the printer, Prof. Rowland employed circuit-combining devices somewhat similar to those described in connection with his multiplex printing-telegraph. Owing to the weight of the printer-carriages and paper-carrying devices hitherto used in printers of this general character, some difficulty has been encountered in moving these devices fast enough, since they are usually slow in starting. Prof. Rowland obviates this difficulty by making the carriage and other traveling parts extremely simple and light.

At the entrance to the harbor of Genoa, Italy, there is an acetylene lighthouse, which has been established two years. In that time many experiments have been tried which go to prove that it is superior to electricity. There is one of this type at Tino, forty miles from Genoa, which cannot be seen from there, whereas the acetylene is plainly visible; the latter is by far the cheapest, costing only $250 per annum, against $5,000 for electricity.

Brief Notes Concerning Patents.

Prof. William Duane, Professor of Physics at the Colorado State University at Boulder, has been recently granted a patent on an improved system of transmitting messages over a wire. It is said that as many as eighteen messages can be sent back and forth at the same time by this new method.

Cassius A. White, of Rome, N. Y., the inventor of the mop-wringer which bears his name and which reaped him a fortune, died on December 8, aged 57 years. The mop-wringer business established by him at Jamaica, Vt., is still carried on, having been organized into a corporation on his retirement over a year ago.

George De Groat, a letter-carrier connected with the post office at Morristown, N. J., has been granted a patent on a recording device for letter boxes. This consists of an electrical connection maintained with the main office, by means of which it can be ascertained at all times if the collections have been made according to schedule. An alarm is given when any effort is made to rifle the box of its contents.

Jacob Olinger, a farmer living on the National Pike not far from Springfield, Ohio, is the inventor of an automatic oiler to be applied to the disks of grain drills, harrows and similar machinery, which is said to be a great convenience to those making use of these implements. Briefly, it consists of a hollow bearing which is kept at all times filled with oil. Mr. Olinger recently sold a shop-right to the Thomas Manufacturing Company for $3,000 and a royalty on each machine equipped with the device.

Anna Catherine Draper, who died on December 12 at her home in Hastings, N. Y., is said to be the first woman to have her photograph taken. Her brother, Dr. John W. Draper, invented an improvement on the Daguerre process by which the time of exposure was cut down from one hour to six minutes, and this made photography available for portraiture. Upon the completion of his process the first picture made was that of his sister, which was examined with great interest. The original is now in the possession of the heirs of Lord Herschel.

Prof. Charles Washington Wynn, who attracted a great deal of attention in mining circles in Denver by his claim of having discovered a process for profitably extracting fine gold from extremely low-grade ores, died very suddenly a few weeks ago, just as preparations were being completed to put his process into commercial use. He had fifty-four patents covering his discovery, and at the time he was stricken he was superintending the installation of the new plant. His secret, however, is not lost altogether, for a description of it written by himself was deposited in the safe of the company.

William Gee, of No. 1885 Bockius Street, Philadelphia, who was the inventor of one of the earliest power looms for weaving carpets, was found dead on December 6 beside an invention on which he was putting the finishing strokes. This device was for knotting fringes in upholstery manufacture, an operation which has been done exclusively by hand. On the day before he had told a friend named Ewing about the wonders of this machine, and invited him to come around the next day, when he said the machine would be in operation. Ewing called according to the engagement and found the inventor dead on the floor, where he had just been discovered by his wife. The deceased was the inventor of a number of other loom improvements.

Josef Hofmann, the pianist, takes his recreation in the shape of automobiling. He has developed not only into an experienced chauffeur, but also into a designer of several automobile improvements. On his arrival in this country a short time ago he at once applied for a patent on a new form of engine. Gasoline and steam are combined in a somewhat peculiar way in this design. He recently said in relation to his invention: "While gasoline is used, it is not a primary power. It is used to generate a high steam power, which steam is itself the motive power of the vehicle. In the steam boiler of the ordinary type the heat surrounds the coils of pipe containing the water. Gasoline exploded in these pipes creates a tremendous heat, transforming the water instantly into steam."

A company has been organized at Hartford, Conn., for the purpose of manufacturing a "yearly-wind" clock, the invention of David Vauthier, a Frenchman who has been residing in Hartford for several years. H. D. Mildeberger, a well-known lawyer of that city, is the president of the company, and he has in his office a clock of this kind which was wound on January 4, 1900. It has been running without an intermission ever since. The movement is said to contain but one heavy spring, which is placed within a drum or barrel. This drum is equipped on the outside with a ratchet-gear connecting with the train. The drum revolves but once a month, and consequently makes but twelve revolutions in the course of the year.

Some Curious Inventions.

The editor of our French contemporary, La Vie Scientifique, M. Max de Nansouty, describes in a rather entertaining manner some curious patented inventions which have recently come to his notice.

One of the patents which attracts his attention has been granted to the Improved Electric Glow Lamp Company, of London, for an improved process of treating incandescent lamps to obtain peculiar lighting effects. The outer surface of the bulb is coated with a mixture comprising an alkaline silicate, silicon, cryolith, and any desired mineral color. Depending upon the particular mineral employed, green, red, orange or any colored light is obtained by the transmission of the rays through the coated glass.

Linen has always been proverbially known for its softness to the touch, but two inventors, MM. G. Florin and H. Lagache, desire to make it still softer to the touch and therefore subject it to a very peculiar process. When the linen has lost some of its softness by the chlorine bleaching process it is first treated with an alkali, whereby the acids which it contains are neutralized. The linen is then immersed in an aqueous solution containing the salt of a tetravalent metal. After this treatment the linen is exposed to the air and becomes as soft as can be desired.

In order to render wall paper impermeable to the moisture that often oozes through the walls of a dwelling, Wilhelm Antony has taken out a German patent for a process whereby the paper is enabled to withstand the action of water. Unsized paper is treated with a solution of rubber in petroleum, and then with a camphorated solution of collodion. Not only is this paper impermeable to water, but it will also resist the attacks of microbes and fungi.

It is not always the easiest matter in the world to slake lime properly. Sometimes too much water, and sometimes too little is used. Sometimes the boiling is too violent; sometimes it is not violent enough. In a German patent W. Olschewsky states that the slaking can be very nicely controlled by adding fine wet sand to the quicklime.

A new method of preserving eggs is the invention of C. Utescher. The eggs are first given a thin coating of paraffine and are then immersed in lime water. The process is so simple that the inventor maintains that its effectiveness can be easily verified by actual experiment.

A formula for a bleaching agent is given in a recent American patent. The vegetable fibers to be treated are impregnated with a solution of soap or a silicate, caustic soda, oil and water. The fibers are then subjected to the action of steam. According to its inventors, Charles F. Cross and G. A. Parkes, of London, this process bleaches rapidly without in any way deteriorating the goods.

AN AUTOMATIC CAR TIPPLE FOR MINE RAILWAYS.

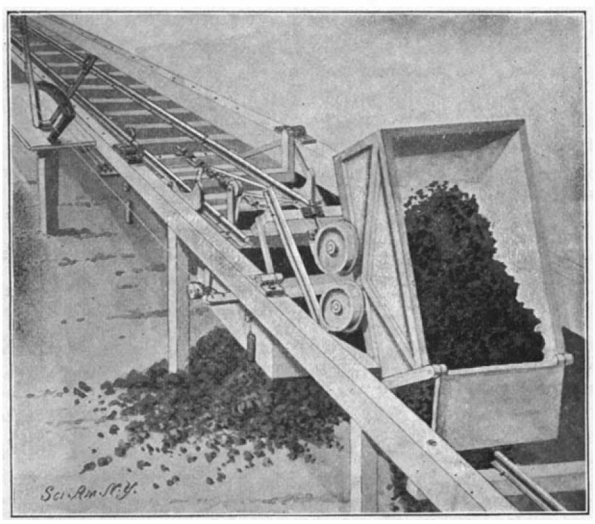
A means for automatically dumping railway-cars successively is the subject of an invention for which the firm of Miller & Geske, of Seattle, Wash., have received a United States patent. The novel feature of the invention is a tipple of such construction that one car is automatically pushed off the tipple by the car next following, which latter car is then dumped in its turn.

The tipple comprises a counterbalanced rocking cradle, the rail-sections of which register with the track-rails. Wheel-chocks are pivoted vertically on the cradle so that they may swing into and out of the path of the car-wheels. The chocks are pivotally connected by links with a sleeve on a longitudinally-reciprocal, spring-pressed rod. The spring-pressed rod holds the chocks normally in operative position. At the rear of the rod a roller is carried, engaged by a tipple lever fulcrumed on the bed of the road.

Each tipple on the line is designed to be actuated by an operating lever. Each operating-lever is connected by a cord with the first-mentioned tipple lever. The tipple-lever furthermore carries a cord connected with a crank on a rock-shaft mounted in the bed of the railway and having an arm arranged to be struck by the car and thrown down.

The rail-sections of the tipple and of the main track may be rigidly held together by latch plates mounted to slide at each side and connected in pairs. The latch-plates are pivotally connected by links with the previously-mentioned spring-pressed rod, so that they are normally thrown into inactive position.

When an operating-lever is pulled to the left, the tipple lever is thrown so as to move the longitudinal rod against its spring, thus throwing the chocks outward and the latch plates into active position. The cradle is thus adjusted so that a car may pass over it unobstructedly, and is also horizontally locked. This movement of the operating lever slacks the cord extending from the tipple lever to the crank of the rock-shaft, thus permitting the crank to fall so that a car may pass over it. But when the operating lever is thrown to the right, the tipple lever will be allowed to assume the position which will permit the chocks to swing inward into active position and the latch plates to move backward into inactive position under the influence of the spring-pressed rod. The cradle will then be allowed to tilt. When a car rolls on a tipple thus adjusted, it first strikes the upwardly-projecting arm of the rock-shaft, during which time the latch-plates will be thrown into active position and the chocks moved out. When the arm has been passed, the parts will return to their positions and the car in rolling on the tipple will engage the chocks and be arrested. The loaded car will then be dumped by its weight, and returned by the counterweight when emptied. When the next car comes along, the upwardly projecting arm will be again thrown down, the chocks

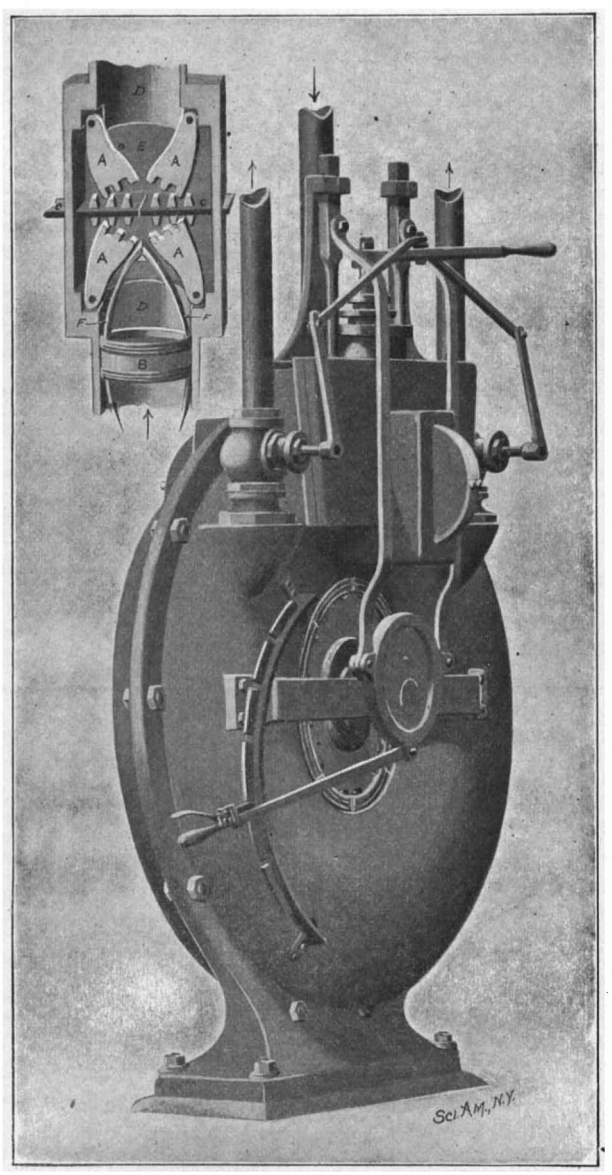


THE MILLER-GESKE AUTOMATIC CAR-TIPPLE.

momentarily opened, and the latch-plates operated. The loaded car strikes the empty car, and before the chocks can move in, the empty car will be driven off the tipple. The loaded car will now be passed onto the tipple, stopped by the chocks, and dumped. The entire action is automatic, it being necessary only to lock or unlock the tipple by actuating the operating-levers. The invention is certainly ingenious and should attract the favorable attention of mining engineers and contractors engaged in excavating.

A NEW ROTARY ENGINE.

Chief among the difficulties which have stood in the way of the production of a successful rotary engine have been those of providing a satisfactory form of valve-gear, steam-ports for the admission and control of the steam, and a suitable sliding abutment to support the reaction of the steam within the cylinder. The accompanying engraving of a rotary engine invented by Robert Sanderson, of Halcyon Hot Springs, B. C., Canada, shows an ingenious attempt on the part of the designer to overcome these difficulties. The piston, *B*, is fitted steam-tight within the cylinder and is provided at both of its faces with V-shaped cam-shoes, each formed by rods fastened to the piston and curved inwardly toward each other. At the upper part of the cylinder casings are arranged in each of which sliding gates, *C*, are fitted. These gates move toward and from each other and serve to close the cylinder so as to form an abutment for the steam pressure. The approach of the piston is utilized to throw the gates into open position—an end attained by forming the gate, *C*, with teeth meshing with the teeth of pivoted cams, *A*, arranged in pairs on each side of the gates. As the piston approaches, the cam shoes, *F*, will spread the cams, *A*, thereby moving the gates, *C*, apart to allow the passage of the piston. The gates are returned to their normal position by means of springs which are not shown in the engraving.



THE SANDERSON ROTARY ENGINE.

The valve mechanism employed to control the steam comprises two steam-chests, carrying valves which command feed-ports arranged in the cylinder at opposite sides of the gates. The valves are moved by connecting-rods attached to the valve-stems and to an eccentric-strap working on an eccentric fastened to the engine-shaft. The throw of the eccentric can be regulated by an arm working with a quadrant held on the cylinder and disposed eccentrically to the shaft, so that by the adjustment of the arm the eccentric will be regulated to increase or diminish the movements of the valve. Steam is led into one of the valve-chests, depending upon the direction in which the piston is to be turned. Exhaust-valves are provided which are thrown in time with the valve regulating admission to the two valve-chests.

Improvement in the Goldschmidt Method of Alumino-Thermic Welding and Casting.

The Goldschmidt process has the disadvantage that it generally requires the use of skilled labor, especially for the welding of rails. With a new modification which has just been made public, an ordinary workman can easily effect a good weld; and the time required for making the mold and running the metal need not be greater than that necessary for jointing a rail, including bonding with copper by the usual method. The "thermit" mixture (of which 1 kilogramme yields 450 grammes of molten iron) is placed in a crucible made of iron plate lined with refractory material, mounted on a substantial tripod and closed at the bottom with one or more small iron plates, according to the quantity of "thermit" used. The "thermit" is covered with a layer of kindling or priming mixture, and an iron plate having a central hole, through which the charge can be ignited by means of a fuse, is placed over the whole. The crucible thus prepared is placed with its tap-hole immediately above the gate of a refractory mold built around the ends of the two rails to be jointed, which are so clamped together that the surfaces to be welded are pressed against each other. When all is ready, the charge is ignited, and in a few seconds the contents of the crucible should become fluid, and melting away the supporting iron plates, should flow into the mold and make the required joint. In this process it is the molten iron which first enters the mold, and the molten corundum slag floating on the top passes out last, instead of first as in the older teeming process. The method lends itself well to the jointing of rails already laid, and insures a sound electrical contact; it is of no use, however, for rails of which the ends are worn, as it does not assist in checking the hammering of the wheels on the rails. The process cannot well be applied to the welding of tubes, as the hot metal is liable to melt its way through the tube at first contact; it is, however, very suitable for the repair of broken shafts or axles, and is especially recommended for use on board ship, as the appliances required are exceedingly simple and convenient.

The temperature of the electrical incandescent lamp has been determined by the French physicist Janet, of the Paris Academy of Sciences. To preserve the heat radiated from the carbon filament of the lamp is a matter of great difficulty, since the filament is separated from the atmosphere by a vacuum. Janet has determined from investigations made with four different lamps, that the filaments attain a temperature varying from 1,610 to 1,720 deg. C. It is remarkable that so high a temperature in an incandescent lamp radiates so little heat. Nevertheless, the radiation is sufficiently pronounced to bring water to the boiling point.

In order properly to harden small articles made from steel it is necessary to treat them individually in a manner that requires experience and skill. Even under the most favorable circumstances considerable loss is entailed, due principally to unevenness in hardening. A St. Louis inventor, Mr. Charles J. Johnson, has discovered that by submerging an article, after it has been formed, at a cherry red temperature, in a solution of sal soda, resin, water, and animal oil, all difficulties are overcome, and that each article is given its proper durability, strength, and elasticity.

RECENTLY PATENTED INVENTIONS.

Agricultural Implements.

HAY AND STRAW STACKER.—ROBERT GRISWOLD, Carr, Col. Mr. Griswold has devised a portable machine for carrying and unloading loose hay and straw. In the construction of the machine a pivoted carrier is included, which operates back and forth upon a body section. This body section can be moved from place to place and held firmly in its adjusted position.

COMBINED RAKE AND STACKER.—ROBERT H. JAHNS, Miami, Tex. This invention provides a horse-rake for hay, which can be used for loading the hay on a wagon or piling it on a stack. The combined hay rake and stacker comprises a frame consisting of two parallel bars having a tongued and draft attachment at its front end and a frame at its rear end projecting at right angles. At the front and rear ends, supporting-wheels are mounted; and at the outer end of the right-angularly projecting frame a supporting and driving wheel is mounted. Over this wheel a single rotatable mast is erected, on which a rake is slidably supported and arranged to rotate therewith. A hoisting-rope, a windlass, and gears are provided, the gears being actuated by the running-wheel under the mast, for the purpose of raising and lowering the rake.

CHECK-ROW ATTACHMENT FOR CORN-PLANTERS.—ELVIS C. ROBERTS, Holdenville, Indian Territory. Combined with a main frame having rear supporting-wheels, furrow-openers, and vertical guides at the front, are marker-wheels and their axle, which axle is arranged to play vertically between the guides. On the axle a toothed wheel is fixed. An elongated lantern-wheel, pivoted at its lower end, has at its upper end a vertically-slotted guide which receives the axle and allows it to play vertically. The seed-dischargers are operated by means of a tappet-wheel fixed on the seed-discharger shaft, and a cam fixed on the lower portions of the lantern-wheel and arranged to engage the tappet.

STRAW-STACKER AND CHAFF-SEPARATOR.—JAMES C. CAROTHERS and NATHAN E. MORRIS, Jr., Franklin, Tenn. The invention is a pneumatic attachment for a threshing-machine, and is arranged to separate chaff from the straw, and deposit them in separate stacks. The machine consists of a straw-drum to which a passage leads, and a chaff-drum to which a passage also leads. Fans are located in the drums; and independent straw and chaff chutes are connected with the respective drums, whereby straw and chaff are separated from each other within the threshing-machine, to be deposited in different piles.

Engineering Improvements.

TOOL.—WILLIAM NEWMAN, Alexandria, S. D. This tool, for removing flues from boilers, comprises a driving shoulder or ring, the diameter of which does not exceed the external diameter of the flue to be removed. A tapered guide extends beyond the shoulder to operate in the flue. In operation the driving-shoulder is fitted in place and the tapered guide slipped up against the driving-shoulder and secured by a nut. The tapered guide serves to direct the shoulder or ring against the end of the flue, so that it can operate as a ram.

BEARING-ADJUSTER FOR CONNECTING-RODS.—CHARLES E. KESTER and CHARLES R. MOORE, Hillsboro, Ill. A gib and key are usually employed for tightening the strap holding the brasses which constitute the bearing of a connecting-rod on the wrist-pin of an engine-crank. To adjust such a bearing necessitates the stopping of the engine. The present invention permits this adjustment to be made without stopping the engine or reducing its load or speed. Two wedges are employed, which work in frictional contact with inclined surfaces on one of the halves of the bearing. By adjusting these wedges toward or from each other, the bearing is tightened or loosened. A screw-shaft and worm-gear serve to operate the wedges simultaneously.

Railway Contrivances.

ELECTRICAL SIGNALING DEVICE FOR RAILWAYS.—WILLIAM A. FARRELL, Wellsville, N. Y. Should a switch be open, the mechanism provided by Mr. Farrell will sound an alarm in the locomotive and also in a station or switch-tower. An attendant in a station can make tests for open switches and signal the engineer when approaching a crossing or arriving at a point where the locomotive-whistle is to be sounded.

FISH-PLATE.—ALBERT M. WILSON, Cherokee, Iowa. The object of this invention is to provide in connection with a fish-plate a simple device operating to hold the plate firmly and permanently in place. The fish-plates are forced tightly against the rails by means of set-screws, and exert a considerable pressure upon the fastening or tie bolts. Thus the tie bolts are prevented from becoming loose, as often happens through the constant pounding of trains.

CAR-COUPLING.—MARK A. BROWN, Douglas, Ga. Mr. Brown has devised a construction by means of which the coupling-pin is readily locked in its engagement with the coupling and readily detached therefrom. The coupling device comprises a bearing provided with communicating slots, the walls of which form a pair of lugs located in a staggered relation. A cylindrical shaft is journaled in the bearing and is free to slide lengthwise and to rock, and is provided with a radial arm extending through the slots and engaging the lugs, and with a handle for rocking the shaft and sliding it lengthwise to engage the lugs.

AUTOMATIC COUPLING.—LOUIS BOIRAULT, Rue Chateaudun 51, Chartres (Eure-et-Loire), France. The draw-head is provided with two inversely-arranged bolts, which are joined by an adjusting balance-lever, so as to neutralize the disturbing effects of shocks. The draw-head is connected with the draft-bar by an extensible frame having a compensating buffer-spring, which prevents any play between the several parts connecting the draft bars of two adjacent cars. A controlling device for the bolts permits not only the unlocking of a coupling, but also its being kept unlocked. The coupling can be adapted without any modifications to the railway-cars at present in use fitted with couplings having screw tension-rods.

Miscellaneous Inventions.

BLOCK.—LAFAYETTE W. JOHNSON, Jerome, Ariz. Ty. The invention relates to a block of that class known as "snatch-blocks" in which parts of the framing or shell of the block are movable to permit a rope to be engaged with the sheave without necessitating the reeving of the rope through the block. To this end the invention comprises a block with a swivel-eye, serving not only to sustain the block, but also removably to engage the rigid portions of the block, so as to hold the rope properly in the sheaves.

MATCH-HOLDER.—ANTON T. ANDERSON AND CARL F. HJERPE, Jamestown, N. Y. This novel simple match-holder is adapted to hang upon an upright support and is capable of holding a considerable number of matches, which can be conveniently and safely removed from the holder at its lower end one at a time or in greater number if desired. Means are provided for scratching the match.

FISH-TRAP.—WILLIAM J. INMAN, Russellville, Ky. The trap is constructed of a flexible, transparent or semi-transparent substance. The best material adapted for this purpose is sheet celluloid. It is tough and not liable to breakage, and, being transparent, readily exposes the bait and is itself partly or wholly invisible, so that it does not frighten the fish as much as other material.

SWIMMING DEVICE.—BYRON J. HOOPER, Portland, Ore. The swimming device comprises a body to which two wings are hinged, limited in their upward and downward movements. Such a device is arranged for attachment to each arm and extends from the elbow to the wrist. The device may also be attached to each leg, and extends from the knee to the ankle. The swimming devices permit the swimmer to make rapid progress through the water.

HEAD-REST.—JOHN R. KIRK, East Las Vegas, New Mexico. The head rest is to be used in railway-cars. The rest consists of a base-piece securable upon a person's shoulder and a hollow longitudinally-slitted post erected upon the base-piece. A standard is slidable in the hollow post and is held at a desired point of adjustment by means of a clamp on top of the post. An offset projection is carried on the upper end of the standard. The offset end of the standard is secured upon the head-rest-block detachably.

PLEASURE-CANAL.—GUSTAV E. PAPE, Brooklyn, New York city. The invention relates to pleasure canals, and more particularly to means for removing boats from a low water level to a relatively higher water level and for maintaining different levels of water in the canal. The pleasure-canal consists of a water-way provided with a wheel for maintaining separate bodies of water at different levels. Adjacent to the wheel are locks connected by conduits with the bodies of water. The conduits can be opened and closed at will. Passengers may ride continuously, without vacating their seats at the terminals for another ride. The economy of power used is noteworthy.

Designs.

ORNAMENTAL STAND.—EDMUND M. SAETTELE, St. Louis, Mo. The leading feature consists of a globe on which the map of the world appears, the globe being mounted on a base having a cylindrical bottom and two superposed tapering concaved portions. A sword and a pen project above the globe.

DRUGGIST'S LABEL-CASE.—ALEXANDER S. BAIRD, Manhattan, New York city. In order to prevent possible mistakes in the selection of labels, Mr. Baird has devised a box in which a continuous strip bearing the labels is to be mounted on a roll. The label strip passes before an opening so that it can be read before being torn off.

BAG FRAMES.—SIDNEY A. KELLER, Manhattan, New York city. The bag frame is curved at the lower edge and at the upper edge at the center. At each side of the central curve are two scallops. The space between the edges are embossed in relief. The other bag-frame has a three-scalloped lower edge, an opposite-curved central dome and a curve at each side of the central dome, each of which curves join the outer curve of the lower edge and of the ornamentation.

NOTE.—Copies of any of these patents will be furnished by Munn & Co. for ten cents each. Please state the name of the patentee, title of the invention, and date of this paper.

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Inquiry No. 1837.—For parties dealing in small armature punchings in large or small quantities.

WATER WHEELS. Alcott & Co., Mt. Holly, N. J.

Inquiry No. 1838.—For manufacturers of burlap or gunny bagging.

Stencil Machines.—A. J. Bradley, 101 Beekman St. N.Y.

Inquiry No. 1839.—For manufacturers of the self-heating flatirons heated by gasoline.

Gasoline Lamps and Systems. Turner Brass Works, Chicago.

Inquiry No. 1840.—For manufacturers of wire novelties.

Glass paper-weights for advertising. Write for prices. Lobmiller Co., Wellsburg, W. Va.

Inquiry No. 1841.—For the address of the Monarch Varnish Co., also the Lilly Varnish Co.

Sawmill machinery and outfits manufactured by the Lane Mfg. Co., Box 13, Montpelier, Vt.

Inquiry No. 1842.—For manufacturers of kitchen commissaries.

Rigs that Run. Hydrocarbon system. Write St. Louis Motor Carriage Co., St. Louis, Mo.

Inquiry No. 1843.—For manufacturers of full-size animals of sheet brass or copper.

For sheet metal stampings and novelties try Standard Stamping Co., Seventh and Hudson, Buffalo, N. Y.

Inquiry No. 1844.—For manufacturers of plumbers' bathroom supplies.

Ten days' trial given on Daus' Tip Top Duplicator. Felix Daus Duplicator Co., 5 Hanover St., N. Y. city.

Inquiry No. 1845.—For manufacturers of heating apparatus.

CANS.—¼ pint and ½ pint tin cans are manufactured by National Cement Co., Toledo, O. Write for prices.

Inquiry No. 1846.—For small acetylene gas generators for the use of street lamps.

FOR SALE.—The patent right of a good-selling portable commode. Address Saunders Bros., Westerly, R. I.

Inquiry No. 1847.—For manufacturers of steel hose.

Partner for a patented fermented milk food, apply to M. L. Arakelian, 417 East 24th Street, New York City.

Inquiry No. 1848.—For manufacturers of engines of ½ to 1 horse power.

For Machine Tools of every description and for Experimental Work call upon Garvin's, 149 Varick, cor. Spring Streets, N. Y.

Inquiry No. 1849.—For manufacturers of machines for making wrapped strings for pianos.

Manufacturers of patent articles, dies, stamping tools, light machinery. Quadriga Manufacturing Company, 18 South Canal Street, Chicago.

Inquiry No. 1850.—For manufacturers of electric railway construction material.

Designers and builders of automatic and special machines of all kinds. Inventions perfected. The W. A. Wilson Machine Company, Rochester, N. Y.

Inquiry No. 1851.—For manufacturers of sodium.

FOR SALE.—Handsome 24-passenger automobile coach; also 2-ton steam freight wagon. Both new. C. Francis Jenkins, 1103 H st. N.W., Washington, D. C.

Inquiry No. 1852.—For manufacturers of good-sized bakers' ovens,

The celebrated "Hornsby-Akroyd" Patent Safety Oil Engine is built by the De La Vergne Refrigerating Machine Company. Foot of East 138th Street, New York.

Inquiry No. 1853.—For manufacturers of small malleable iron castings.

Experienced draughtsman desires position. Gas engines preferred, technical education, good references. Address Draughtsman P. O. Box 773, N. Y.

Inquiry No. 1854.—For a battery motor for running a sewing machine.

WANTED—Patent articles of merit to manufacture and place on the market. Will buy or pay royalty. Give full particulars. Address Sidney Folder Co., Sidney, Ohio.

Inquiry No. 1855.—For manufacturers of ice yachts.

WANTED.—Experienced draughtsman on mill machinery and machine tools. Permanent employment assured to rapid and accurate draughtsman. Bethlehem Steel Company, South Bethlehem, Pa.

Inquiry No. 1856.—For manufacturers of small figures of animals and persons of papier maché.

EXPERIMENTAL MACHINE SHOP.—We are not using our shop at present. Well equipped with lathes, shaper, woodworking machinery, etc. Will rent use and power very low. Fine place for automobile work. Billings Clapp Co., Boston, Mass.

Inquiry No. 1857.—For braiding machine for braiding covering on cable formed by seven No. 20 electric single lamp cords, one in center, the others around.

The Excelsior Machinery Co., of 25 Whitecross Street, London, England, proprietors of inventions in special machinery, are prepared to develop, exploit and negotiate the sale of patented inventions, protected in Great Britain and Europe, a so open to undertake the exhibit and sale of any class of machinery; having spacious warehouse and showroom accommodation with power, etc.

Inquiry No. 1858.—For dealers in Parson's steam turbines.

☞ Send for new and complete catalogue of Scientific and other Books for sale by Munn & Co., 361 Broadway, New York. Free on application.

Inquiry No. 1859.—For a cutting machine for chicory root.

Inquiry No. 1860.—For machinery for grinding mineral paint.

Inquiry No. 1861.—For a machine to cut paper rolls for music passing over rolls. Also for hand punches suitable for such work.

Inquiry No. 1862.—For manufacturers of wooden cannons with spring attachment that could throw a rubber ball about 150 feet.

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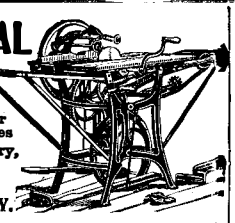

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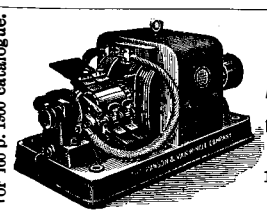

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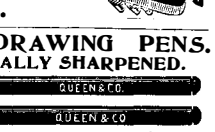

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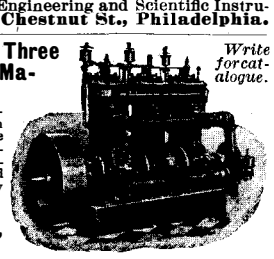

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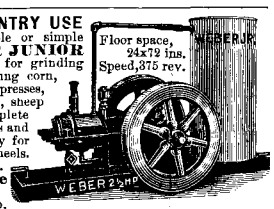

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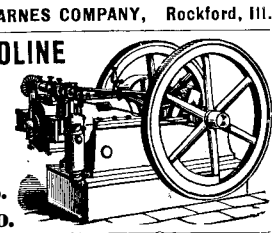

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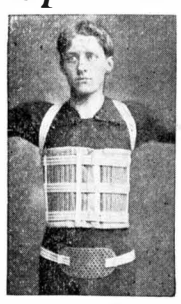

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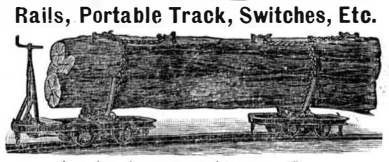

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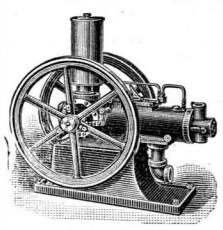

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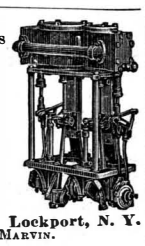

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Milk tester, centrifugal, D. H. Burrell & Co.	37,589
Necktie holders, F. L. Churchill	37,544
Ointment, J. G. Elm	37,585
Packing house products, certain named, Schwarzschild & Sulzberger Company	37,554
Paints and insulating materials, Aktiengellschaft fur Asphaltirung und Dachbedeckung vormals Johannes Jeserich	37,568
Pens, fountain, L. E. Waterman Company	37,530
Precious stones for jewelry, imitations of, Regnell, Bigney & Co.	37,531
Pressing irons, compressed air and gas heated, Sheftall & Hilborn	37,588
Remedy for certain named diseases, Protectine Co.	37,580
Remedy for colds, coughs, and grippe, W. C. Simpson	37,578
Remedy for coughs, Six Hour Cold Cure Co.	37,577
Remedy for rheumatism, Valentiner & Schwarz	37,579
Rubber belting, hose, and packing, Combination Rubber and Belting Company	37,597
Rubber, certain named articles manufactured from, Goodyear Tire & Rubber Co.	37,598
Salve, E. I. Rice	37,586
Sewing machines, O. L. Chase	37,590
Sewing machines, Illinois Sewing Machine Company	37,591
Skirt edgings and bindings, Velutina Bias Co.	37,543
Stockings, A. L. Brown	37,547
Stone, artificial, Silicicite Stone & Emery Wheel Co.	37,603
Tablets with figures in relief, Martin et Cochard	37,534
Tea, Sprague, Warner & Company	37,567
Teething rings, W. L. Strauss & Co.	37,572
Tonic, T. A. Miller	37,583
Washing machines, E. H. Huenefeld. 37,592 to	37,595
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"Rescue," for a medicine, C. L. Robb	8,880
"Scottish Rite," for cigars, F. J. Graves & Son	8,874
"Stand On End Ruberoid Roofing," for roofing, Standard Paint Co. 8,885,	8,886
"Tissera's Famous Ceylon Teas," for teas, V. L. Tissera & Co.	8,876
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"Velvet Skin Complexion Cream," for complexion cream, C. W. Waterman Company	8,881
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"Delmac Liver Regulator," for a medicine, Delmac Medicine Co.	440
"Buttercups and Daisies," for wall paper, Lawrence & Bullen	444
"Mulberry Bush," for wall paper, Lawrence & Bullen	443
"Nuts and May," for ladders, Lawrence & Bullen	442
"The Miller," for ladders, Miller Ladder Company	441

A printed copy of the specification and drawing of any patent in the foregoing list, or any patent in print issued since 1863, will be furnished from this office for 10 cents, provided the name and number of the patent desired and the date be given. Address Munn & Co., 361 Broadway, New York.

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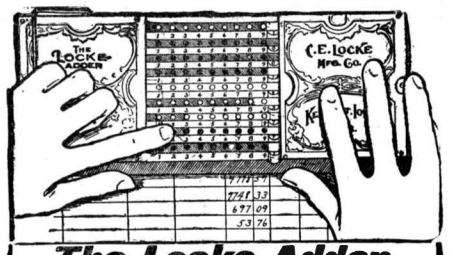

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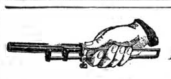

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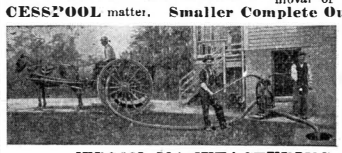

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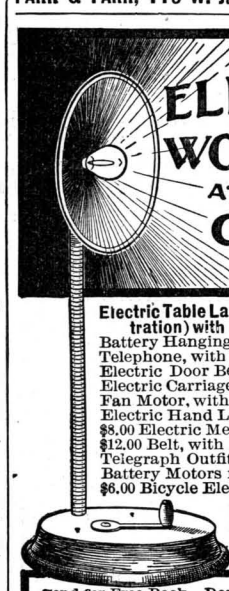

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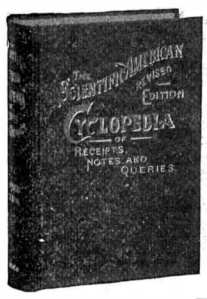

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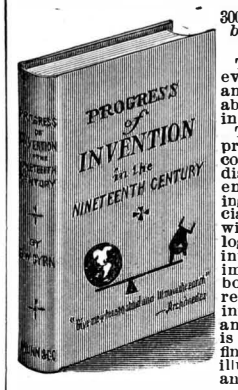

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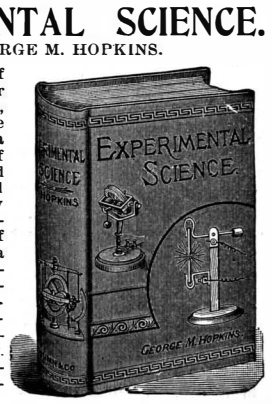

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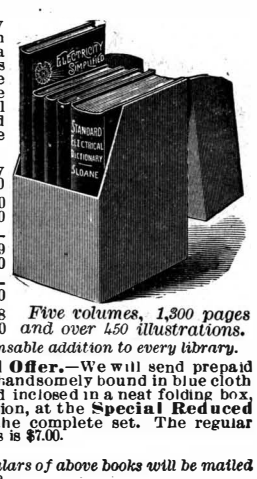

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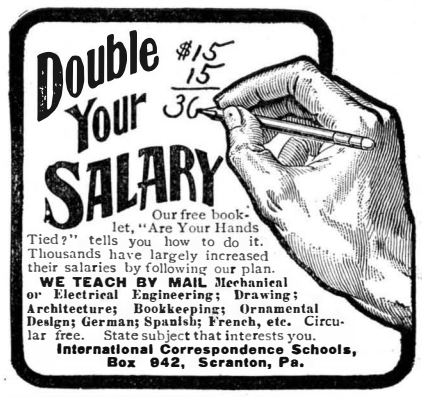

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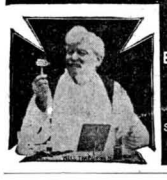

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(8496) W. L. J., Jr., writes: I was much interested in your article in the SCIENTIFIC AMERICAN of November 16 in regard to the "wind pressure gage," and how the pressure of the wind on a square foot of surface indicates the velocity per hour. Will you kindly give me the rule for finding this? You say 1⅛ pounds = 15 miles, 4½ pounds = 30 miles, and so on. On this basis I make 3⅛ = 25 miles, 12½ = 50 miles, but how can one figure on a pressure of say ½ pound or find the pressure of a 10-mile breeze? A. The formula for velocity of the wind from the observed pressure is $\sqrt{200} \times$ pressure in pounds per square foot = velocity in miles per hour; and for the pressure derived from the observed velocity the formula is V^2 in miles per hour $\times$ 0.005 = the pressure in pounds per square foot.

(8497) W. F. G. asks: Will vulcanized fiber answer for the insulation on static machines, and are vulcanite and vulcanized fibers identical? A. Vulcanized fiber will be but little better than wood as an insulator in this position. Vulcanite is hard rubber and is a different substance from fiber.

(8498) E. L. asks: 1. Can you tell me, without knowing the amperage, the voltage being 50 volts, if a 75-watt dynamo or 1-6 horse power as motor will light 5 lamps of 10 candle power at full capacity? A. Ten-candle lamps may be taken to be from 3 watts to 4 watts per candle. One lamp will consume from 30 watts to 40 watts, and 75 watts will light two such lamps. 2. What is the resistance of No. 16 iron wire? A. Pure iron has a resistance 6 times as great as copper. Ordinary telegraph wire has a resistance 15 times as great as that of copper of the same size. No. 16 copper wire has 248.81 feet per ohm. Pure iron wire of the same size would have 41.47 feet per ohm, and No. 16 ordinary iron wire would have 16.19 feet per ohm. 3. If a current of 10 amperes at 108 volts goes through 540 feet of No. 16 iron wire, what will be the electromotive force and current remaining after it has gone through, and how to calculate it? A. There will be 10 amperes remaining. But there will not be any volts remaining, if the wire constitutes the entire circuit between the mains. The same amperes flow through the entire circuit and come out at the other end, just as the water flows through the entire length out of a pipe open at both ends and comes out at the other end. The drop of potential along a wire is proportional to its length, provided it is of uniform sectional area, as it may be presumed to be in this case. This being so, there will be a drop of one volt for each four feet along the wire. 4. Can we run a direct-current motor with an alternating current? The motor is not loaded. A. Yes; if it be started and brought up to synchronism with the current by hand, or by some other power. It will then keep step and run by alternating current.

(8499) C. W. N. asks: 1. Approximately how large a spark coil is needed in wireless telegraphy to transmit through a distance of one mile, and how large for a distance of five miles? A. A coil giving a spark one inch long will transmit one mile over water. Over land the spark length varies with the character of the surface. A coil giving a ten-inch spark will answer for a variety of distances, and circumstances. 2. In winding a large spark coil in which the greatest amount of wire is placed on the middle part of the coil, I have learned that it is customary to leave a space between the core and the wire at the ends. Is there any disadvantage in winding so that the wire lies directly on the main insulating tube? A. The space is left because of the greater tendency of the spark to jump from the secondary into the primary as the ends of the coil are approached. See Hare's "Construction of Large Induction Coils," price $2.50 by mail. 3. Is there any better insulator than paraffine for use in the construction of coils? A. Paraffine or a heavy oil is employed. 4. What is the best material to use in separating the sections of the secondary? A. Hard rubber disks. 5. Are there any means by which the voltage of the secondary wire of a coil may be determined? A. Widely different estimates are to be found of the voltage necessary to force a spark through various lengths of dry air. There is no rule giving a certain result for lengths beyond a few centimeters.

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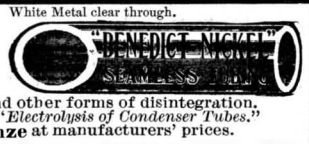

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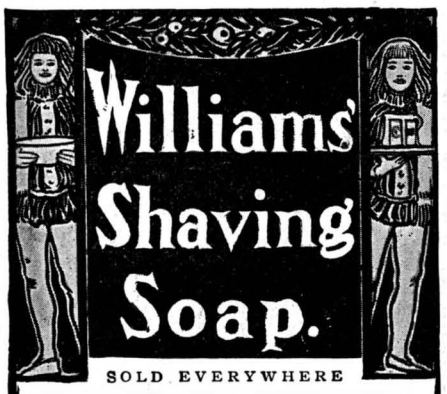

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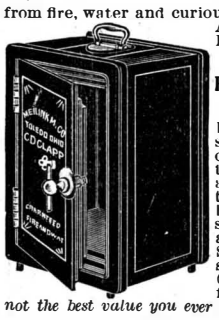

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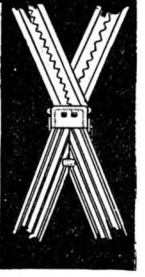

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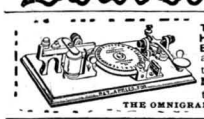

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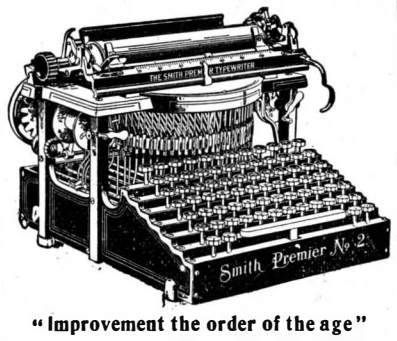

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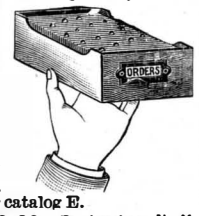

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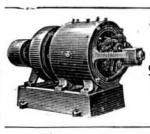

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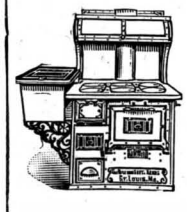

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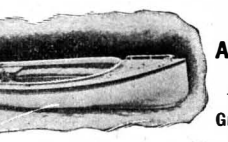

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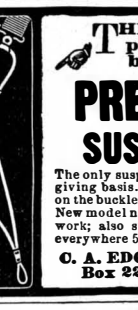

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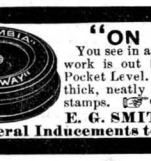

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